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DO UNTO OTHERS—

Among the different shop utilities shown in this issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, there may be one or the other that will arouse your attention. There even may be one that will kindle your admiration or at least arrest and hold your interest for more than a brief moment.

Whether you consider the value of the utilities shown as being small or great, they will serve their purpose, if they stimulate you to think about devising something that will do a little better one or the other thing that you or your students do in the school shop.

The publication of these shop utilities is to accomplish one other thing, and that is to incite in you the determination to show others how you solve your problems, just as the writers of these articles are showing you what they have done to solve theirs.

Any device which helps man accomplish a little easier or better the things that he has to do is the result of careful planning and thinking. Have you anything of this kind that may help your fellow teachers in their work of training the youth of our country? Record what your planning and thinking has produced. Have your shop utilities published and help others, as others have tried to help you.

THIS MONTH'S COVER

Our cover picture this month shows another lumbering scene. A giant of the forest is shown at the moment when, succumbing to man's superior force, he is about to crash to the earth. The picture was taken in the Plumas National Forest, California.

Photo by A. G. Varela, Courtesy U. S. Forest Service.

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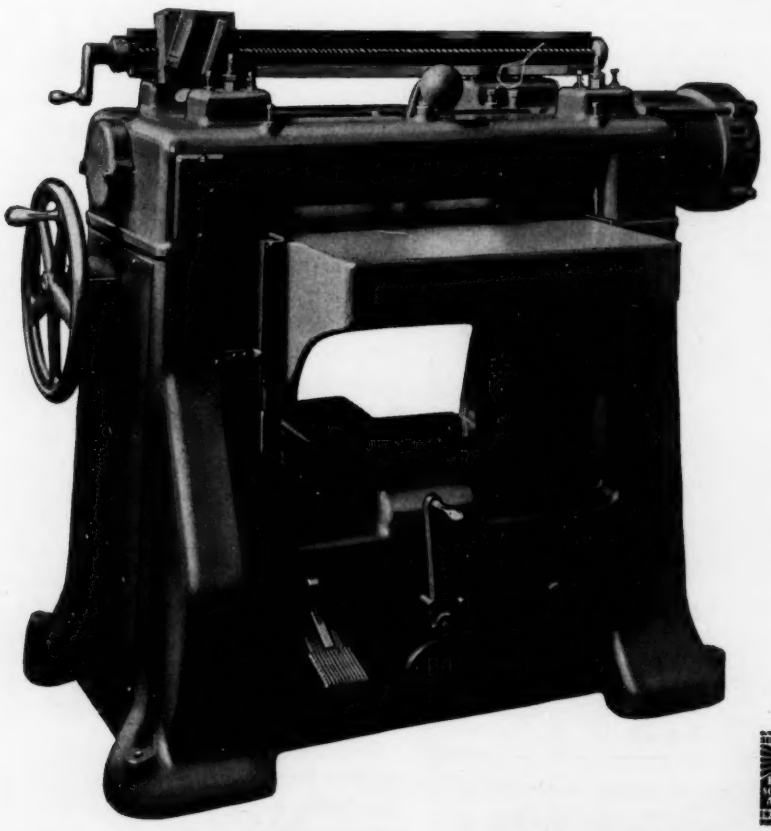

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BELOIT, WISCONSIN, U. S. A.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOLUME 21 AUGUST, 1932 NUMBER 8

Visual Instruction in Industrial-Arts Education

*Emerson Wm. Manzer**

IN this period, when various phases of industrial-arts education, such as related subject matter, industrial information, educational and vocational guidance, junior research, reconstruction of the curriculum, and the integration of subject matter, are especially stressed, it seems necessary to turn to some practical form of instructional material that will assist in the successful solution of these problems. It is recognized by many in the profession that the knowledge now obtained by boys and girls from their contacts with tools, materials, and books, does not fully meet the modern demands of industrial-arts education. It is necessary, therefore, to supplement the traditional shop activities with a motivating factor that will have a direct appeal to youth; one that will materially aid in the attainment of present-day objectives by presenting interesting and absorbing experiences, and by creating new learning situations designed to promote industrial-arts programs.

Such a motivating factor is visual instruction, because this, when well planned and organized, clarifies the work of the shops, arouses new interests and ambitions, presents a vivid and dynamic picture of the industrial world, and transmits new and pertinent facts that may serve as a basis for the integration of shop-work with other subjects of the general curriculum. Visual instruction is not a new method of education. Ever since the first cave man scratched his crude pictures on the walls of his rocky abode we have had some form of visual education. Comenius believed in this form of instruction to the extent that he produced his *Orbis Pictus*. Present-day textbooks are profusely illustrated because it is recognized that fully 90 per cent of all education comes through the sense of sight. By using films or slides of a technical nature it is possible to expand the activities of the shop so that they will extend into the major fields of industry. Here the impressionable and imaginative minds of youth will have an opportunity to see not only what industry is doing and the methods employed, but also what industry demands from its trained workers, common laborers, junior and senior executives, and highly skilled technical men. Through class discussions and junior research in various industries and professions much valuable information will be obtained for vocational and educational guidance. As an example of junior research, one or two boys interested in mechanical engineering can find out what the mechanical engineer needs to know, where he can get his education, how much high-school work he should have, what his salary is, and what the future holds for one who is well trained. The same can be done for every position in a local shop, plant, or business that boys are acquainted with. Ample class time, some outside preparation, and a regular classroom for discussion are the prerequisites for good results in this type of industrial-arts work.

*Bronxville, New York.

Shop Excursions

In order to present a more vivid mental picture as to the value of visual instruction as an aid to the solution of the aforementioned problems, let us use a movie film to go on a "shop excursion" with a group of boys who are in a general-metal class. The instructor has prepared the boys for the presentation of the picture. They know that they are going to see how the iron used in their projects is made, and that the iron is considered a precious metal because of its basic use in the making of steel. They know that the United States is a leader in the production of the world's output. Many other valuable facts and points have been stressed so that the boys know what to look for. Now the opportunity has arrived for the clarification of the facts, the abstract is going to become complete. As the story of iron unfolds before the inquiring minds of these future workers they learn that the world's production of iron is 130,000,000 tons annually. A chart shows the United States leading in the production of iron with an output of 45 per cent, France 41 per cent, Great Britain 8 per cent, Sweden 5 per cent, Germany 4 per cent, Luxemburg 4 per cent, and all other countries 13 per cent. These are enlightening facts and can be used as chart material for teaching industrial information. Another chart shows the production of iron ore in the Great Lakes region of the United States. Eighty-five per cent is mined there, 2 per cent at Birmingham, Alabama, and 2 per cent in New York and Pennsylvania, while 3 per cent comes from all other sources. The average

yearly production of iron ore in the states is 61,000,000 tons. All of these are significant and educational facts. Graphically these boys are shown the location of the various ore mines in Minnesota, Northern Wisconsin, and Upper Michigan. The large open-pit mines with their steaming giant steam shovels are graphically depicted. Train loads of ore moving along on different levels are pictured, as is also the ore dock where car after car of ore is dumped directly into the huge ore boats. All of this presents a wealth of material for related and technical information that books could not relate in such inspiring and absorbing manner.

Next the loaded boat is seen coming through the locks of the Sault Sainte Marie canal on its way to the steel mills at Gary, Indiana, Cleveland, Ohio, or to the inland steel centers of Pennsylvania. An animated drawing shows clearly how the blast furnace is charged with the coke, limestone, and ore; how the hot blast is turned on; and how slowly but surely the metal begins to trickle down to the tapping hole of the furnace. Then the furnace is tapped, and the white-hot metal, sparkling and crackling, rushes out and winds its way down the clay-lined troughs to the big ladles. Then it is cast into molds that are arranged on a conveyor which carry the pig iron directly to the freight cars that will transport it to the many iron and steel foundries throughout the country.

The "shop excursion" is over. In a flash we are back in the classroom after a visit to these interesting mines hundreds of miles away. "Boy, that was an interesting picture!" remarks one of the boys to his pal. "It sure was." "I got a lot of good information from that picture," says another. "That picture sure prepared me for the oral English report which I must make on the manufacture of iron," says a third.

In like manner it is possible to present interesting and stimulating information to all industrial-arts classes. Facts presented in this manner stick, and form excellent material for the integration of subject matter.

Integration of Subject Matter

The proposed reconstruction of the curriculum that educators talked about at the recent N.E.A. convention at Washington, and at the Progressive Education Convention at Baltimore, calls for the integration of the subjects. In the social studies many of the boys have studied, or will study, transportation, mining and minerals, manufacturing, agriculture, and numerous other factors that make up our industrial and economic structure. Charts showing some of the foregoing facts will make excellent teaching aids for either the shop classes or the social-science classes. For example, two or more boys may be assigned to take a map of the United States and by various methods locate the sources of raw materials, industrial centers, and their products. Another group may make a chart showing the world's production of iron. Graphs can be made in the mathematics class, oral topics can be presented in the English class, the historical background of the iron and steel industry will give very illuminating information for someone in the history class. Collections of minerals, wood, chemicals, nails, screws, form excellent illustrative material either for class use or for the hall showcase, all of which have great integrating value. Other original and challenging tasks may be devised to bring about a solution of the problems.

Suggestions for Using Industrial Films

It is advisable to review all visual instructional material before it is presented in the classroom. This enables the instructor to record important facts and points of interest, so that he effectively uses every means offered by the film to render vocational and educational guidance. It helps him to show the part that the mechanical engineer has played in the development of the machinery and of the methods used; or to point out the field of the chemical engineer, of the electrical engineer, of the heads of the organization, and explain the duties of the minor executives, such as the foreman, the timekeeper, and the shipping clerk. These films make it also possible to show the relationship between the employer and the employee, give safety information, and show the work of the entire social organization. Some of these facts may even be discussed before the picture is shown so that the class is prepared for the subject. One way in which this might be done is to assign one member of the class to present an oral report on the subject the day before the visual instruction is presented. Before showing a picture, the instructor should be careful to see that all things are ready, that the machine is working, that the films are wound correctly, the lenses clean, and the screen is in place. Talking by the students during the lesson detracts attention. Questions should be saved until the lesson is over. Then the topic should be discussed at the next class meeting if possible. To determine the effectiveness of the lesson give a short quiz on important points. Book films for the entire semester and try to organize the visual program so that it fits in with the course of study. In a general shop it is somewhat difficult to accomplish this, but one can organize the work so that it will be most effective.

Sources of Supply for Industrial Films

Most industrial films may be secured free of charge, except for transportation. The Bureau of Foreign and Domestic Commerce, Washington, D. C., has coöperated with the Bureau of Mines, Pittsburgh, Pa., in the production of a number of excellent films. They may be obtained by writing to the Director, Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa. Many subdistributing centers are maintained in various parts of the country making it comparatively easy for any school to make use of the films. A descriptive list of films may be had for the asking.

Manufacturing plants are also coöperating in the work of education by producing excellent pictures that are lent to schools free of charge. Some of the list include:

Northwestern Electric Co., Rochester, N. Y.
Westinghouse Electric Co., East Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
U. S. Steel Corporation, 71 Broadway, New York City.
International Harvester Co., 606 South Michigan Ave., Chicago, Ill.
Carborundum Co., Niagara Falls, N. Y.
Eastman Kodak Co., Rochester, N. Y.
E. C. Atkins and Co., Indianapolis, Ind.
Reading Iron Co., 401 North Broad St., Philadelphia, Pa.

Lincoln Electric Company, 12818 Coit Road, Cleveland, Ohio.

American Steel & Wire Company, 208 S. La Salle St., Chicago, Ill.

Cleveland Twist Drill Co., Cleveland, Ohio.

Henry Disston and Sons, Inc., Philadelphia, Pa.

The extension divisions of state universities also are sources for films and slide supply. Catalogs of visual instruction material may be secured from Educational Screen, Chicago, Ill., National Board of Review, New York City, the Industrial Department of the International Committee of Y.M.C.A.'s, 347 Madison Avenue, New York City, and Victor Animatograph Co., Davenport, Iowa. A small fee is charged for some of this material but it will be found invaluable for programing a series of industrial films or slides.

How to Get a Projection Machine

There are some schools which do not have motion-picture or slide-projection machines. It is possible to rent these machines for a nominal sum. One method is to rent a projector, arrange for a good program of interesting pictures, and then charge a small sum for a school show after school hours. The income will soon make it possible to purchase a projector for your own shop.

For information on any phase of visual instruction one may write to Visual Instruction News, University of Kansas, Lawrence, Kansas. *Motion Pictures in Education*[1] will be found to be a very practical handbook for users of visual aids.

[1]Thomas Y. Crowell Company, 393 Fourth Ave., New York City.

Sheets from a Stage Carpenter's Notebook

*Page Kirk**

(Concluded from May)

Oriental

ORIENTAL settings require but little furniture. Usually they consist of hangings, rugs, a distinctive doorway and a couch or throne; with, perhaps, the addition of a stand and a stool. The couch is a backless sofa hidden under drapery and piled with bright cushions. The effect should be luxurious magnificence. The throne in Figure 4 consists of two strips of wall board stiffened at the back with strips of wood up either side and across top and bottom. A 1 by 4, ends shaped or planed, supports the curtain which hides part of the wall board. The visible edges extending on either side are sawed out along the line of a pilasterlike design with which it is painted, a design chosen as representative of the country in which the play is laid. The motive may be varied at will, but it must suggest a support. Flyflappers, in gorgeous colors, carried by huge slaves in equally rich costumes, should flank the platform. As here drawn, the large circle on the curtain forms the background to the royal head and crown. The pilasters and the footstool are the most distinctive parts of the throne and, together with the hanging, must be correct in pattern. Other treatments are suggested under "Versatility" in the general directions. Stands and stools are sufficiently varied to supply almost any demand, Biblical or secular. The chair is deliberately made nonperiod to be generally suitable.

Chinese and Japanese

Band saw and wall board are needed to form much of the ornate scrollwork on the Chinese and Japanese pieces. Wooden furniture is finished in gold or lacquer. The colors should be cinnabar red, which is a sealing-wax red, or black. Paint is sold under such easily recognized names as "Chinese Red" or "Lacquer Red," and is, of course, oil. Water paint should only be used for the stone furniture of gardens.

As a whole, Chinese and Japanese scenes are very different, although some pieces are usable in both. An indiscriminate hodgepodge is as inexcusable in the set as a Chinese girl costumed in a kimono or a Japanese girl in trousers. Much of the difference is shown in the back drop and hangings, however, which are not included in this discussion of furniture.

There are some plays laid in the lands of the dragon and of the sun, but the most general demand for such staging comes from operas and operettas, in which cases floor space must be kept for the choruses. The few pieces of furniture are almost certainly used by the star actors, therefore should attract the eye, not an easy accomplishment when in competition with the gorgeousness of the costumes. To dominate, the furniture must be a contrasting mass of one color, hence the undesirability of decorations, however, pleasing they may be in themselves. If gold must be used, dispense with color, use gold alone. But it has a disconcerting way of being lost in the *tout ensemble*. Then too, even radiator gilt is expensive when used in quantities. In the few exceptions when decorations are really an addition of anything but work, choose large bold designs and do them in bold contrast to the background color. Gold spattering is good, if the spots are large, not under half an inch. If less, they will blend with the background and dull it. The only sure way to test for size is to try a sample where it is to be used and under the same light.

Box Throne

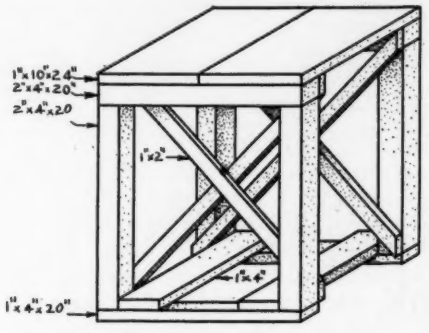
Bill of Material

Wall Board: Two pieces 4 by 8 ft., cut into four lengths 32 by 28 in. for arms, two lengths 38 by 24 in. for back, one

*Washington, D. C.

length 24 by 24 in. for seat, front, two lengths 4 by 32 in. for arms, front, two lengths 4 by 6 in. for back, above arms.

Wood: One board 1 by 10 in. by 4 ft., cut into two 24-in. lengths for top of seat, one board 2 by 4 in. by 10 ft. cut into six 20-in. lengths for top and corners, three boards 1 by 4 in. by 12 ft. cut into four 30-in. lengths for arms, four 28-in. lengths for arms, four 24-in. lengths for back and braces, two 20-in. lengths for base, two boards 1 by 2 in. by 8 ft. cut as used, for X braces.



CONSTRUCTION FOR SEAT OF BOX THRONE
FIG. 7

4 pc. 1 by 4 by 28 in.	Top and Bottom of Sides	
4 pc. 1 by 4 by 30 in.	Sides of arms	Seat
2 pc. 1 by 10 by 24 in.	Top	Seat
2 pc. 1 by 4 by 24 in.	Base	Seat
2 pc. 1 by 4 by 20 in.	Base	Seat
6 pc. 2 by 4 by 20 in.	Uprights and top	Seat
Cut as used, 1 by 2 in.	X Braces	
2 pc. 1 by 4 by 24 in.	Top and bottom	Back
2 pc. 1 by 4 by 36 in.	Sides	Back

Construction. Build according to drawing and cover with wall board. It is not necessary to cover both sides of the back, but the wall board adds to the strength since it replaces the bracing here omitted. Allow ¼ in. extra for wall board whenever there is an overlap.

The throne can be made any dimensions wished, or boxes profitably substituted for the framework. Glass is sometimes shipped in crates much the shape of the back and arms. A large box may even be used alone, without the back and arms.

The seat, back, and arms are made as separate units and should be left as such for ease of storage. When in use the slightest fastening which will hold the parts in place is sufficient, since there is no strain. Also as independent units it is susceptible of varied combinations. By laying the back across the seat tablewise a sacrificial altar is evolved, adequate if painted stone gray, improved by suggestions of barbaric carving.

Chinese Throne
Bill of Material

Wall Board: One strip 4 by 8 ft., cut into one piece 9½ by 23 in. for front of seat, one piece 26 by 40 in. for back of seat, two pieces 20 by 23 in. for outside of arms, two pieces 20 by 6 in. for inside of arms.

Wood: One piece 1 by 8 in. by 12 ft., cut into four 29-in. and one 13-in. length for back and seat. One piece 1 by 5 in. by 6 ft., cut into one 29-in. and two 21-in. lengths for seat and arms. Two pieces 1 by 3 in. by 8 ft., cut into two 20-in., two 10-in., one 29-in., one 24-in., and two 23-in. lengths. One piece 1 by 4 in. by 4 ft., cut into two 20-in. lengths.

2 pc. 1 by 8 by 29 in.	Back, sides C
1 pc. 1 by 8 by 13 in.	Back, top of
2 pc. 1 by 8 by 29 in.	Seat
1 pc. 1 by 5 by 29 in.	Seat
2 pc. 1 by 5 by 21 in.	Arms, inside
2 pc. 1 by 3 by 10 in.	Corners, front, D
2 pc. 1 by 4 by 20 in.	Arms, front
2 pc. 1 by 3 by 20 in.	Base, sides
1 pc. 1 by 3 by 24 in.	Base, back
1 pc. 1 by 3 by 29 in.	Brace, front
2 pc. 1 by 3 by 23 in.	Side, seat supports, E
2 5-in. Angle Irons	Back

Construction. Make full-sized drawing of curved parts and dragon. Fold the back on center line and trace second dragon. Transfer outline of back to wall board, and the curves to boards C which are to be cut as shown in illustration. Saw on line. Construct frame, using angle irons to strengthen back. Paint with "Chinese Red" or "Lacquer Red" oil paint; dry and decorate. Outlines and shadows on decorations should be done in dark red, the color of a shadow thrown on body color. Test under stage lighting. Drapery over back should give effect of being Chinese brocade, yellow or some other contrasting color, and front of seat A should be piece of same cloth, or wall board painted to match it. Place throne on three-tier platform and use Chinese throne stool No. 5. In

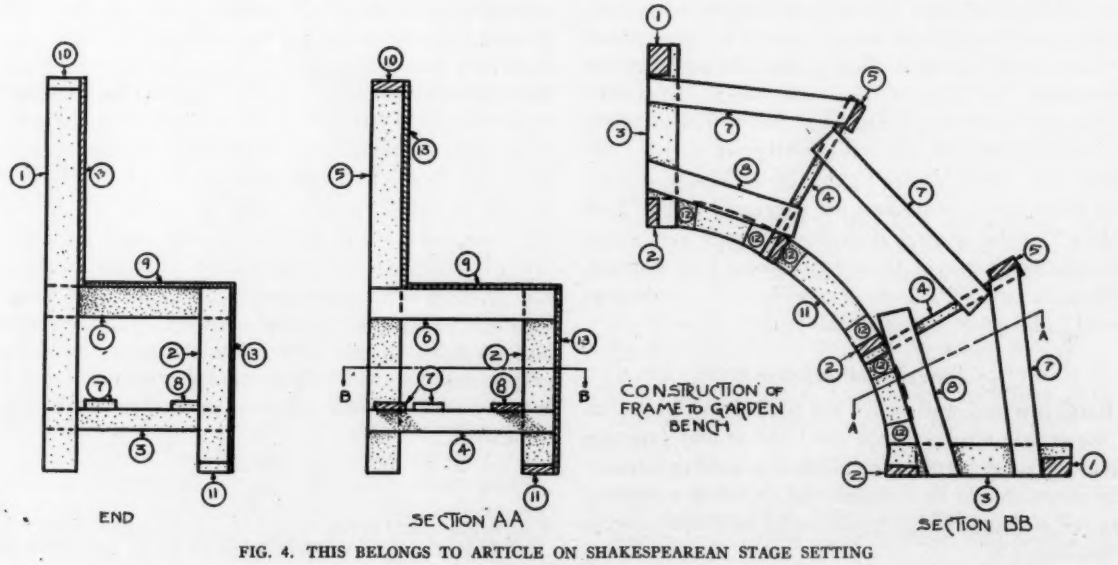


FIG. 4. THIS BELONGS TO ARTICLE ON SHAKESPEAREAN STAGE SETTING

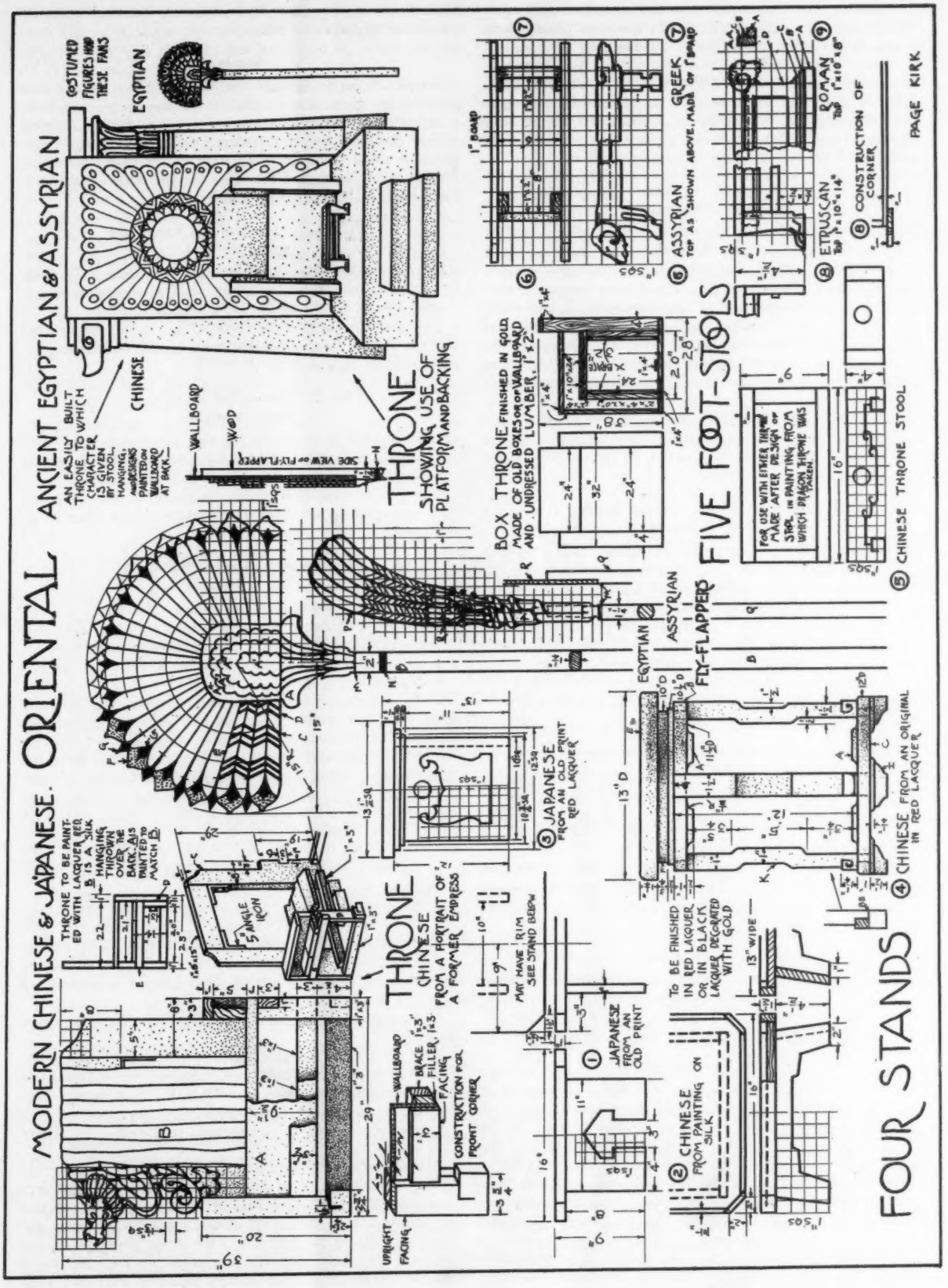

MODERN CHINESE & JAPANESE. ORIENTAL
ANCIENT EGYPTIAN & ASSYRIAN
EGYPTIAN
COSTUMED FIGURES HOLD THESE FANS
CHINESE
AN EASILY BUILT THRONE TO WHICH CHARACTER IS GIVEN BY STOOL, HANGING, AND DESIGNS PAINTED ON WALLBOARD AT BACK.
WALLBOARD
WOOD
SIDE VIEW OF FLY-FLAPPER
THRONE SHOWING USE OF PLATFORM AND BACKING
THRONE TO BE PAINTED WITH LACQUER, RED, B IS A SILK HANGING THROWN OVER THE BACK. AIS PAINTED TO MATCH B.
5" ANGLE IRON
THRONE CHINESE FROM A PORTRAIT OF A FORMER EMPRESS
MAY HAVE RIM SEE STAND BELOW
WALLBOARD
BRACE 1"x3"
FILLER, 1x3
FACING
CONSTRUCTION FOR FRONT CORNER
UPRIGHT FACING
① JAPANESE FROM AN OLD PRINT
② CHINESE FROM PAINTING ON SILK
③ JAPANESE FROM AN OLD PRINT RED LACQUER
④ CHINESE FROM AN ORIGINAL IN RED LACQUER
TO BE FINISHED IN RED LACQUER OR IN BLACK LACQUER DECORATED WITH GOLD
13" WIDE
FOUR STANDS
EGYPTIAN
ASSYRIAN
FLY-FLAPPERS
BOX THRONE FINISHED IN GOLD MADE OF OLD BOXES OR WALLBOARD AND UNDRESSED LUMBER, 1"x2"
FIVE FOOT-STOOLS
⑤ CHINESE THRONE STOOL
FOR USE WITH EITHER THRONE MADE AFTER DESIGN OF STOOL IN PAINTING FROM WHICH DRAGON THRONE WAS TAKEN.
⑥ ASSYRIAN TOP AS SHOWN ABOVE. MADE OF 1" BOARD
GREEK
⑧ CONSTRUCTION OF CORNER
ETRUSCAN
ROMAN
PAGE KIRK

FIG. 6

the painting from which this is taken, the empress sat cross-legged on the seat, apparently upon a low stool placed there. If the throne is too large, reduce by one fourth.

Footstools

Much of the distinctiveness of the throne depends upon the footstool. The designs shown in Figure 5 are all scale drawings from authentic pieces. They are in order of difficulty, five having least work, nine most.

No. 5. Chinese
Bill of Material

One piece 1 by 7 by 14 in. for top, two pieces 1 by 4 by 7 in. for ends, two pieces 1 by 4 by 16 in. for front and back.

Construction. The top is fitted into frame made of sides. Only the front is decorated. Since the beauty of the stool depends upon the proportions of the decoration, it necessarily must be accurate. Draw one half on tracing paper, fold and trace other half. Paste drawing on wood and saw on outline. Circle may be bored or painted. The small square and round spirals are in relief on the original and should be painted to appear so.

This stool is from the same painting in which the dragon throne was found. Although the two are companion pieces, it may also be used with the box throne. On the original the circle was filled with the royal crest.

Nos. 6 and 7. Assyrian and Greek
Bill of Material

One piece 1 by 6 by 8 in. for top, two pieces 1 by 2 by 6 in. for ends, two pieces 1 by 5 by 16 in. for sides.

Construction. Both follow directions given for No. 5, except that No. 6 is strengthened with blocks glued and screwed into the corners, and No. 7 is strengthened in the same manner by means of its legs. Press the drawings of the heads well into the wood. If this is properly done, the outline will show through the body paint, and can be easily followed with a darker tone. As with the Chinese stool, the effect should be of carving.

Nos. 8 and 9. Etruscan and Roman
Bill of Material

One piece 1 by 10 by 14 in. for top, two pieces 1 by 1½ by 12 in. for sides, two pieces 1 by 1½ by 8 in. for ends, two pieces ½ by ½ by 13 in. for side braces, four pieces 1 by 3 by 4 in. for legs.

Construction. Same as for others except that top rests on the frame instead of dropping into it. The legs are apt to be weak, therefore special care should be taken to fasten them securely.

Bill of Material

Roman No. 9. One piece 1 by 8 by 10 in. for top. Two pieces 1 by 4½ by 8 in. for ends. Two pieces 1 by 6 by 16 in. for sides, D. One piece ½ by 1¼ in. by 5 ft. for trim C. One piece ¼ by ¼ in. by 5 ft. for trim B. One piece ½ by ½ in. by 5 ft. for trim A.

Construction. Same as others except for base molding which may be built up, as shown at AA No. 9, or made of molding. If the latter is substituted, care must be taken to select a classical molding, not a colonial adaptation. If the throne faces the audience in such a position that only the front of the stool shows, the front molding alone will be required, but if the sides are visible it will be necessary to carry it around the side. In no case will a back trim be needed.

Footstools are usually low, but if any of these are wished higher they are easily changed by enlarging them to scale or by changing the squares across the designs to rectangles, as was suggested in the directions for the settle and wing chair, Figure 4.

Finish is harmonized with that of the throne. They may be identical or they may be in contrast, but both must be considered as parts of a whole.

Stands

Stands are so in demand for Chinese and Japanese sets that two are given of each kind; a low one for tea and food, a higher one for flowers, vases, etc. No. 4 is from a drawing of one that was used in the throne room of a Japanese emperor. A stand stood on either side of his chair, one being for the royal sword, and the other for the official seal. Folding screens extended to right and left.

No. 1. Japanese Tea Stand, Low
Bill of Material

Two pieces 1 by 8 by 18 in. for top. Two pieces 1 by 8 by 11 in. for ends. If rim is added, such as shown on No. 2, one piece ½ by 1½ in. by 6½ ft. cut as fitted.

This stand is easily made. The cut-out is best constructed directly on the wood, since its looks depend on absolute accuracy. Paint lacquer red.

No. 2. Chinese Tea Stand, Low
Bill of Material

One piece 1 by 12 by 15 in. for top. Two pieces 1 by 5 by 16 in. for sides. Two pieces 1 by 5 by 13 in. for ends. One strip ½ by 1½ in. by 6½ ft. cut as fitted, rim.

The base is typically Chinese. Originally it was black lacquer with gold figures. Solid red is usually more effective on the stage.

No. 3. Square Japanese Stand, Tall
Bill of Material

One piece 1 by 13½ by 13½ in. for top. Two pieces 1 by 10 by 13 in. for sides. Two pieces 1 by 8 by 12 in. for sides. One strip ½ by 1 in. by 4 ft. for molding under top, cut as fitted. One strip ½ by ½ in. by 4½ ft. for molding under top, cut as fitted.

Draw half design, fold on center line, trace other half and make four blue prints. Paste on four side boards and saw along outline. If necessary, use 6-in. wood, cut out separate halves of design and fit together. If this is done, build the base around a 1 by 8 by 8-in. square bottom. Circles are truer if cut with a drill. Circles may be painted, not cut, the family crest being used as the decorative motive. Paint with gold, red or black lacquer.

No. 4. Tall Round Chinese Stand
Bill of Material

One piece 1¼ by 14 by 14 in. for top, E. Four pieces 1 by 8 by 14 in. for top B and base C. Two pieces 1½ by 6 by 12 in. for foot, H. Two pieces ¾ by 6 by 12 in. for top F. Two pieces ½ by 6 by 12 in. for top G. Four pieces 1½ by 1¾ by 13 in. for legs, K. Two pieces ½ by 6 by 12 in. for A.

Glue together the halves of F, G, B, and C; leave in clamps until dry.

Cut out circles and glue together E, F, and G. Saw out legs and notch to fit G and C, top notches being on inside and bottom notches on outside. See BB (4). Notch G and C to fit legs, G on outside, C on inside. Glue legs to G and C. Leave all glued parts in clamps until thoroughly dry. It will take several days.

Shape feet H and decorative pieces A. This is done by first sawing semicircles; then drawing shape of foot H or piece A on outside. Saw along outline. The shaped surface just cut should fall on the radius of the circle. By reversing the curve and fitting the feet into each other, four can be cut from one semicircle, otherwise it requires two since the widest part of the design is more than an eighth of a circle. On the contrary, with decorative pieces A, the widest part is exactly one eighth, therefore the eight pieces can be made from one

circle. Glue A and H in place, being careful to center H under legs and A in spaces between. For security, put one screw into each piece A and two into each foot H. Allow the glue to dry thoroughly.

Glue top and base together. Since the stool is almost entirely fastened together with glue, care must be taken to use a good quality of furniture glue, to clamp securely and to dry thoroughly. The latter takes time and cannot be rushed.

The spiral on each foot is an addition but not a necessity. Paint with red lacquer.

E, F, and G could be turned from one piece if a lathe is convenient. However, since many junior high schools, and some senior high schools as well, have dramatics but no lathes, any piece shown in these designs may be made on a bench, although in some cases it requires ingenuity to make that statement possible.

Flyflappers or Fans
Egyptian
Bill of Material

Wall Board: One piece 28 by 32 in. for fan. One strip 15 in. by 5 ft. for center A.

Wood: One piece 1¼ by 2 in. by 5 ft. for handle B. Construct as shown. Draw one half each of A^1, A^2, A^3, A^4, fold on center line and cut out on outline. Open and use as templets to cut parts from wall board. Glue together as shown. Draw design directly on wall board, cut out edge and paint as follows: G bright blue, C black, E red, D blue, F gold. This is the coloring of the original, a very old Egyptian fan. Center A is to give the effect of carved wood and is made of layers of wall board extending along the handle as far as M, to which it is both glued and nailed. Use wall-board nails; the heads will be hidden by the paint. Glue A to the fan and dry under a weight. When ready, glue and nail fan to handle B. Gild A and handle. Band N on handle is red.

Assyrian
Bill of Material

One piece of wall board 12 by 30 in., for fan P. One length of wood, round or square, 1¼ in. by 4 ft., for handle.

Wall board extends down to M. Draw design directly on this, cut out, glue and nail to handle Q. Gild handle and fan as far up as R. Q is supposed to be wood overlaid with gold and the feather holder A, extending from M to R, represents gilded metal into which is fastened the brightly painted feather fan P. The latter may be done in any bright colors wished by the costume committee.

Use water paint for the fans, radiator paint for the gilded parts.

Hygiene of Vision in the School Drafting Room

*A. K. Rigast**

(Concluded from July)

Semi-Indirect Lighting. This system combines the advantages of the direct and the totally indirect lighting. Part of the light reaches the work directly, and part of it is directed to the ceiling and the upper parts of the walls from where it is reflected upon the work. The lower part of the luminaire should be of good diffusing material, whereas the upper part should be of clear glass. If good diffusing glass is used of sufficiently low transmission, this system provides good lighting.

Since this system uses the ceiling and the upper part of the walls in order to redirect a large part of the light, the color of these parts of the room must have a rather high reflection factor. Cream color, not white, is a desirable tint for these parts. Naturally the ceiling and the upper part of the walls must be properly maintained, since the accumulation of dust and dirt on them will greatly reduce the reflection factor of the color, thus materially affecting the efficiency of this system of lighting.

The Totally Indirect Lighting. Under this system all the light reaches the work indirectly; that is, after it has been reflected from the ceiling and the upper parts of the walls. As in the semi-indirect system, the color of the ceiling and the upper part of the walls must have a high reflection factor so as to increase the efficiency of this system.

This lighting system is excellent because it provides good, soft illumination, as well as uniform distribution of light, low surface brightness, and reduces shadows to an absolute minimum. It also eliminates all glare from polished surfaces and slightly glazed paper. Since all the light is reflected from the ceiling, it is possible for the light to penetrate to every corner of the room.

It is self-evident that this system meets the requirements of the modern school drafting room, and therefore it should be found wherever drafting is taught.

Method of Determining the Amount of Artificial Light

It may be taken for granted that the teacher of drafting must know more about drafting-room illumination, whether natural or artificial, than anyone else on the faculty. Supposing the school administration should ask him to specify sufficient and proper lighting for his department, how will he go about it? He may feel that the lighting in his room is insufficient, how is he going to prove his contention? To know only the advantages and disadvantages of the three systems of lighting previously discussed will not help very much. The drafting room may be equipped with either semi-

*High School, Sacramento, California.

indirect or the totally indirect lighting system and yet have insufficient light. How many lights are necessary? How far apart should they be spaced? What should be

culation of proper and adequate lighting (see Figs. 5 and 6).

Before the calculation can be made, the size of the

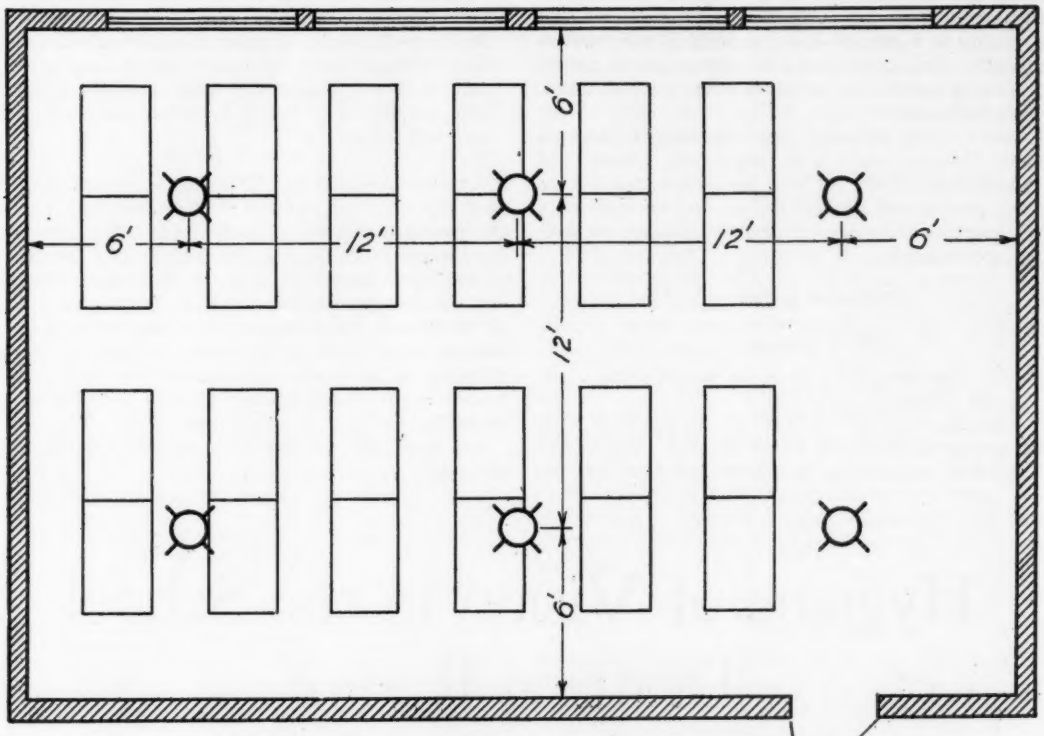


Fig. 5 Floor Plan Illustrating Permissible Spacing Between Outlets And Between Outlets And Sidewalls

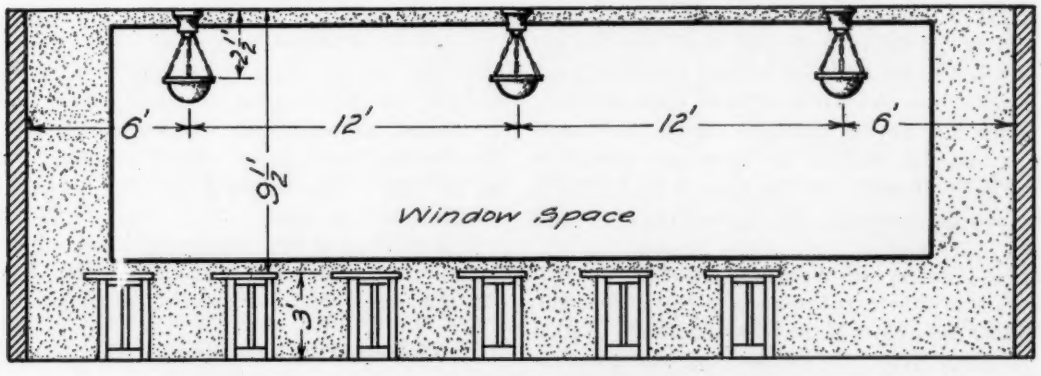


Fig. 6 Elevation Illustrating Spacing And Mounting Height Of Luminaires

the size of the luminaire? What is the proper hanging height of the luminaire? How much illumination in foot-candles should be provided for the drafting room? What is the relation of the floor area to illumination? What is the amount of light in lumens emitted by the luminaires? All of these factors are involved in the cal-

room must be known, as well as the amount of lighting necessary in foot-candles.

Let us assume that the lighting system desired for the drafting room is the totally indirect. Let us also assume that the size of the drafting room is 24 by 36 feet, or 864 square feet in area. Experts on school light-

ing recommend from 10 to 15 foot-candles for the drafting room. It is safe to assume, therefore, that 12 foot-candles will furnish adequate illumination.

Knowing these facts, we now can work out the following equation, which was developed by the American Engineering Standards Committee:

$$L = \frac{A\ I}{E\ N}$$

Where L = the number of lumens emitted by each lamp. ("The lumen is the light falling upon an area of 1 square foot, all points of which are 1 foot distant from a source having an intensity of one candle." One lumen, therefore, is sufficient to give 1 foot-candle of illumination on 1 square foot of surface.) See Figures 1, 2, and 3.

A = area of floor space in square feet.

I = illumination in foot-candles required.

E = coefficient of utilization. (This is defined as "the ratio of the light flux [lumens] received on a given plane to the total flux from the lamps illuminating it.")

N = the number of lamps required.

Let us now apply this formula to a given situation. The size of the drafting room was previously assumed to be 24 by 36 feet, or 864 square feet in area. It also was indicated that only the totally indirect lighting system will be considered in the following discussion.

If the ceiling height is 12½ feet, how large should the luminaires be to give proper and adequate lighting if they are spaced 12 feet apart, and 6 feet between them and the side walls? It should be noted that this distance of spacing of luminaires is recommended by illumination experts. Figure 5 shows that this spacing requires six ceiling outlets. It was also previously noted that 12 foot-candles will furnish sufficient illumination. In this problem the coefficient of utilization is 0.33, if the ceiling has a reflection factor of 70 per cent (cream color), and the walls 50 per cent (light gray, or stone buff). We then have $A = 864$, $I = 12$, $E = 0.33$ and $N = 6$ and substituting these values in the formula

$$L = \frac{A\ I}{E\ N}, \text{ we have}$$

$$L = \frac{864 \times 12}{0.33 \times 6} = 5236 \text{ lumens}$$

In order to offset the decrease of illumination, due to dirt and dust, experts allow a safety factor of 1.3. Multiplying 5236 by 1.3 we get 6807 lumens which must be emitted from each of the 6 luminaires.

What size lamp should be provided in order to obtain the foregoing illumination? In the accompanying table, lighting experts have worked out the relation of the lamp sizes in watts to the initial lumens emitted.

Light Emitted by Gas-Filled Incandescent Tungsten Lamps

Lamp Size (watts)	*Clear Lamp Initial Lumens*
75	885
100	1,290
150	2,145
200	3,060
300	4,950
500	9,050
750	14,325
1000	20,000

Examination of this table reveals that a lamp of 300 watts will emit 4,950 initial lumens which is 1,857 lumens less than is required by our calculations. On the other hand, a 500-watt lamp is too powerful. If we would take 10 foot-candles as is recommended by some authorities instead of 12 as we did at first, then evidently a 300-watt lamp will give sufficient illumination. Therefore, each of the six luminaires of our hypothetical drafting room must be equipped with one 300-watt gas-filled incandescent tungsten lamp.

What should the size of the globe be to house a 300-watt bulb? In the table below are given the recommended globe sizes of good diffusing glass.

Lamp Size	*Globe Diameter*
50 to 75 watts	8 inches
75 to 100 watts	10 inches
100 to 150 watts	12 inches
150 to 200 watts	14 inches
200 to 300 watts	16 inches
300 to 500 watts	18 inches

From the table above we learn that a globe 16 inches in diameter is large enough to house a 300-watt bulb.

In brief, our imaginary drafting room must be equipped with six luminaires, spaced 12 feet apart, and 6 feet between them and the side walls, the size of the lamps must be 300 watts, and that of the globe 16 inches in diameter.

Conclusion

A subject of this nature cannot be exhaustively treated in one article. There still remains much to be said. The chief aim of this discussion is to call the attention of other workers in the field of drafting to a subject of vital importance, a subject which deeply concerns all teachers of drawing.

It is not necessary for the drafting teacher to be an illumination expert. He must know, however, what constitutes a proper and adequate lighting situation. He should work for ever better lighting, and he should demand ideal lighting conditions. The realization of an ideal is difficult. This, however, should not deter him from striving toward it.

The teacher's duties toward the student do not only involve the teaching of the subject, but also the safeguarding of the pupil's health. The first and last responsibility of the school is the welfare of the child. No nation can live if its children are weak; no nation can decay if its children are healthy, for in the health of its children lies the wealth and the security of the nation.

WOODWORKING SHOP IN JUNIOR HIGH SCHOOL, PHILADELPHIA, PA.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

THE PROBLEM THAT CONFRONTS VOCATIONAL EDUCATION

The present period of unemployment places the school administrator in a rather difficult position. On the one hand the necessity for severe retrenchment places a handicap on what he may undertake, while on the other hand there is a real demand to extend an opportunity to the many unemployed who desire to attend school in order to profitably use what would otherwise be wasted time.

There are some pessimistic enough to suggest abolition of all shopwork in school. "Why should we try," query they, "to train machinists, patternmakers, carpenters, and plumbers in our schools? There are no jobs for them anyway." True, at the present time, even good mechanics with years of training cannot find employment. The most confirmed pessimist, however, is looking for a change. While it may look dark and dismal at present, there is sufficient historical precedent to know that the country revives after each one of these economic upheavals to a period of greater prosperity. The skilled worker of today will again be in demand in the future. He must be available when the call comes — hence his training must go on and it must be thorough.

Past experience, however, suggests that our vocational education may have been too narrow. Instead of developing a tradesman of a certain kind, it may be well for the school to give the student certain specialization based on a broad foundation. Thus the machinist might be given a thorough grounding in machine-shop practice, just as he is at present, but in addition he might be given the underlying facts and manipulative skills that the heat treater, the welder, and the structural-iron worker must know and have.

Skilled workers, so broadly trained, would not have to fear the technological unemployment we now read so much about, as they would be able to more readily adjust themselves to changes which the future might bring. Probably the best scheme for this broad type of training would be by means of short-unit courses. The units would be very adaptable, not only in taking care of unemployed, partly trained persons who want to get an opportunity to extend their education in the direction which would be of most individual assistance to them, but they would also break up the work of the main course in such a way that smaller groups could be accommodated the year round on the various units. In other words, the general-shop idea might be found advantageous even in the full-time vocational school.

This method of attacking the problem would have another advantage. Since the work would be so arranged that smaller groups would be simultaneously engaged at the various units, a minimum amount of equipment per unit would be required. Furthermore, all of the equipment would be in constant use thus reducing the heavy overhead caused by large, fully equipped shops standing idle for a part of each school day.

In this way, real economy could be achieved — not by criminal abolition of needed schoolwork, but by the thoughtful and sane extension and administration of that which is offered.

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HOW TO SOLVE PROBLEMS

Quite a number of years ago, a certain teacher was blithely engaged in putting his drafting room in order for the opening of school. Some of the changes which he had made required hard manual labor, but he did not mind that, because he could see how much more conveniently some of the work in his classroom could be done during the coming year. The hard work had its usual effect on this teacher's appetite, too, and he was frankly admitting that he was waiting for dinner time on this particular Friday morning.

His efforts at placing a big cabinet into a space that was just a little too snug for comfort, as well as his anticipatory thoughts about dinner were suddenly interrupted by an unexpected buzzer call to the school office. Hastily washing off the grime and perspiration incident to his labors, he quickly put on his collar, necktie, and coat, and hurried down to find out what the summons meant.

After being informed that the principal wished to see him, he repaired to the office occupied by that dignitary, and was duly informed that he was not to teach the same class that he had the year before, but that quite a different group of more matured students had been assigned to him. He was further told that everything had been removed from a certain classroom which would henceforth be his drafting room, and it was intimated that he should see that the required benches, drawing boards, and other needful paraphernalia be brought to the room at once, so everything would be ready for opening of class on Monday morning at eight o'clock.

Fortunately, the teacher was too much stunned to express his feelings at this sudden upheaval of all of his plans. A minute previously he was glorying in the fact that he was practically ready to go, with all of his work definitely outlined, his room arranged just as he wanted it, all of his lessons in order, and a class of his favorite boys returning, and now instantly all his plans were overthrown and he must start out with an entirely new set-up, a room, which at the moment was bare of everything, with nothing definitely prepared, and with only a day and a half before his new class was to be in full stride. Ye Gods! such bungling.

He returned to the room in which he had just been so gleefully working and sat down. All joy had been taken out of his life. Dinner didn't matter — there was no appetite for it anyway. The early part of the afternoon was spent at cussing the principal, fate, teaching jobs, and things in general. Another hour was spent trying to get sympathy from other teachers who, however, were generally too busy to stop and listen to the tale of woe. Finally at about four o'clock, this teacher went to the newly assigned room and after spending another half hour in bitter denunciations he decided to start equipping the place. By six o'clock the room at least had lost its bare look, and by three Saturday afternoon, it looked decidedly livable and ready to accommodate any class that might be sent there on Monday next.

Monday morning came and with it the new class. They were all fine fellows. Five minutes after the opening bell the class was fully under way. Presently the principal came in and after a quick critical survey of the entire room complimented the teacher on his fine coöperation and excellent work in an emergency. Once more that instructor felt as thought he were on top of the world. Later on, he thought back over the whole affair and then he concluded that the entire happening contained much that might be exceedingly useful for the future.

His first conclusion was that when confronted by an emergency problem, little could be gained by bewailing the fact that the problem had arisen. Secondly, that time spent in sympathizing with one's hard luck seriously interferes with the work required to remove that which made the sympathy seemingly necessary. That it is much better to remember and act on the old saying "Well begun is half done." Thirdly, that the accomplishment of certain tasks may be impossible, but that it is useless to declare them so before one has actually made a serious effort at their performance. Lastly, that the solution of any problem, the achievement of any task, brings with it its own reward, and that this compensation is in direct ratio with the difficulty of the accomplished task or of the solved problem.

But why this long story? The writer related it largely because it contains so much that might help teachers who are laboring and suffering under conditions which they also could overcome if they went at it in the right way. Take, for instance, the question of increased class size. There are still many shop teachers who feel that efficient teaching cannot be carried on if there are more than twenty students in a shop. It used to be fifteen, but the acceptable number has been gradually raised to twenty. There are teachers, however, who successfully handle much larger classes. These teachers, too, are honestly striving to do the very best for their students. Confronted by the fact that there are teachers who successfully handle classes with a membership that far exceeds twenty, would it not be better to stop saying "It can't be done" and open-mindedly find out how it is done. No doubt, these teachers who are opposed to increasing the class size are honest, hard-working, earnest men. There is no doubt either that they could not successfully teach a larger class if they tried to do it with their present system of teaching. But these well-meaning men could conserve much energy, and avoid much mental suffering if they would but approach this question with an open mind, anxious to learn what others already have accomplished, and eager to add to their findings the individual discoveries that actual first-hand contact with the problem would bring to them.

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WE MODERNS

The century in which we live is truly wonderful when compared to those that have preceded it, especially when one looks at the advances made in things pertaining to the invention and perfection of mechanical and electrical contrivances. In other lines, too, great progress has been made, but with our successes has come the inevitable human pride of that which has been achieved, and if not an open, then a tolerant disdain of what our forefathers had accomplished. Occasionally, however, one gets a jolt which unbalances this complacency when by chance it is suddenly discovered that the things which we do today, and of which we feel quite proud, were done a hundred or more years ago.

Most of us think of vocational guidance as a new movement which was brought to life by the advent and progress which vocational education has made in the past decade or two. It was quite a shock, therefore, when the writer recently stumbled onto a book entitled *The Book of Trades* published in London in 1825. The preface contained another surprise, because it stated that the book was the "twelfth edition." It further stated that the new edition had been enlarged, and that it contained "five hundred questions for the exercise of students."

Another paragraph taken out of the preface reads as follows: "In a commercial empire, like the United Kingdom, to acquaint the rising generation with details of various trades, and with their origin and history, must be considered as a praiseworthy effort." Evidently the writer had the modern conception of the need of vocational guidance. His 4¼ by 6¾-in. book contains 466 closely printed pages, seventy illustrations, and describes 83 different professions, trades, and occupations. Besides this, there is an appendix containing "Representations and descriptions of the principal machinery used in the manufacturies of Great Britain."

A glance at this little volume would convince anyone that the advances made to date are not so great or so extraordinary. It is rather surprising that they have been so trivial and so few considering the groundwork which has been provided for us, and upon which we may build our improved structure.

Class Management in the Foundry

*Thomas J. Brown**

THERE is absolutely no reason for discussing class management in the foundry unless we firmly believe that the foundry is an important part of the technical work in high schools and trade schools. When we consider that we daily come in contact with so many things that are wholly or in part produced in the foundry, or that are made by machines which are composed largely of cast iron, foundry practice surely ought to be given a prominent place in the secondary school.

To teach foundry effectively one must consider its purpose. The foundry not only enters in one way or another into most of the modern inventions but the best college-trained men are required to supervise and operate them. Students in engineering, designing, metallurgy, and architectural work can benefit by a course in the foundry. Mr. Hoyt, executive secretary of the American Foundrymen's Association, once said, "To give these students a course in foundry while in high school is like teaching a first-grade student numbers. It is the right subject at the right chronological age."

Moreover the subject has a great appeal to the student. It is adapted to his age because it employs both hand and mind and because it satisfies the idealism of the adolescent age. He can see in his foundry work a foundation for the later realization of his dreams; the mixing of various forms of metals which may be used in the construction of airplanes, automobiles, and large machines. He learns to appreciate the beauty of metals.

Moreover, the foundry is a vital factor in correlating the various high-school technical subjects. In machine drawing, for instance, a student draws and designs problems which are carried over to patternmaking, from patternmaking to the foundry, and from the foundry to the machine shop.

In planning to teach the subject effectively one must consider (*a*) the equipment, (*b*) content of the course, and (*c*) method of teaching.

The Equipment

The necessary equipment for teaching the fundamentals in a technical high school with 24 in a class should include 1 small-sized cupola, 22 in. inside diameter, with blower; 1 gas furnace, with blower and pyrometer, capable of developing 2,400 deg. F. and holding a No. 25 crucible; 1 core oven with four shelves; 1 buffing-wheel stand with 2 wheels; 1 emery-wheel stand with 2 wheels; 1 core bench with inclosed compartments and lockers; 1 workbench with 8 vises; 1 sand-blasting machine with air compressor attached; 1 power drill press; 24 benches and 24 sets of molder's small tools (slick, trowel, mallet, spray can, draw spike, vent wire, rammer, sprue, shovel); flasks; patterns; core boxes; files; finishing tools; crucibles; crucible handles and tongs; ladles; ladle handles and tongs; and the following supplies: 15 bbls. molding sand; 2 bbls. core sand; 5 gal. core oil; 50 lb. gluten, and 25 lb. wheat flour for core binders; 2 bbls. fire clay, 1 bbl. plumbago, and 1 bbl. soapstone for facings; 50 lb. limestone, and 25 lb. zinc chloride for fluxes; 5 tons pig iron, 500 lb. copper, 500 lb. aluminum, 100 lb. tin, 100 lb. zinc, 100 lb. lead, 50 lb. antimony, 25 lb. ferrosilicon, and 25 lb. ferromanganese.

Content of the Course

The course should be divided into as many units as the instructor considers necessary to cover the work. The following units are given in the order of their importance:

Unit One. *Molding:* This should cover the fundamentals in making a mold, tools used, composition of the materials used.

Unit Two. *Coremaking:* This covers the mixing, making, setting, and baking of core.

Unit Three. *Furnaces:* This should cover the operation and care of furnaces including the cupola; also materials used in repairing.

Unit Four. *Metallurgy:* This should cover the production of all basic metals; mixing, melting, pouring, and behavior of all metals and alloys.

Unit Five. *Finishing castings:* This should include hand finishing, tumbling, sand blasting, and pickling.

Unit Six. *Production:* This covers a regular sequence of work starting out with simple molding methods followed by the use of the follow board, match plate, the molding machines, and strippling machines.

Method of Teaching

The teacher may guide the student through (*a*) the instruction sheet which gives definite directions for completing an assigned job, and (*b*) the contract sheet which develops the fundamental principles of the theory and applies them to mechanical operations. This contract serves as a correlator between text, instructor, and job.

The instruction sheet serves at least five purposes, for it:

1. Trains the student in orderly methods of attacking a job.
2. Arouses interest in the work because the student has a definite aim.
3. Gives a sense of satisfaction to the student with successful accomplishment of the job.
4. Compels the student to refer to his textbook on certain operations that may not be clear in his mind.
5. Puts instructional material in permanent form for future reference. Using unit No. 1 as an illustration, the instruction sheet on that unit teaches the student the fundamentals in molding and may be referred to in the making of more complicated molds.

The *contract* should be very definite. It is to cover a unit of work. Each contract consists of a number of topics concerned with the unit.

In the use of the contract sheet the boy's work is twofold. First, he must get information on each topic. He gets this information either from the instructor's demonstration or from his text. After having gathered it, he must write it up as a theme in his notebook. The contract sheet makes the boy study for a complete understanding of the unit. It also aids the instructor in checking the boy's work, through his notebook. The instructor should give tests in which the boy will have to use his notebook in order to be able to answer the questions. The questions should be of such a nature that they will not check just the information gathered but will indicate whether the boy understands the work well enough so that he can organize and apply what he has learned.

Application of the Method to Units

The first unit of work is accomplished by an instruction sheet which covers the fundamentals in making a simple mold. A general sequence in Unit One refers to this instruction sheet. This saves repetition.

The sequence starts with a common mold covering the fundamentals and leads through more difficult patterns involving coping down, the use of checks, gaggers, chaplets, various kinds of gates, headers, risers, use of facings, and fire-clay wash in floor molding.

While the instructor makes a mold, the students use the instruction sheet to check the operations. The class has the opportunity of asking any questions which it sees fit.

*Lane Technical High School, Chicago, Ill.

(Sample Instruction Sheet)

UNIT ON DRY SAND COREMAKING

Instruction Sheet

A student is given two days making cores and one day baking. He must complete one 3-part core, and one core made with loose part-core box. Each class is provided with a compartment in which to place all unbaked cores. Each compartment is equipped with 2 mallets, and 2 strike-offs. General tools, such as spray cans, core boxes, wire, brushes, and plates are left on the bench.

Operations as demonstrated:

1. Riddle sand and add binder.
2. Mix sand and binder thoroughly (this is important).
3. Add water to about 2/3 of the sand and keep the rest dry in case the sand gets too wet. The wetter the sand, provided it does not stick to the box, the better the core is made.
4. Fill core box with sand, reënforce if necessary.
5. Ram and strike off.
6. Roll core box on the plate, rap, and withdraw loose parts, remove core box.
7. Place as many cores as possible on the plate.
8. Spray the cores with molasses water and put them in the compartment until baking day.

Third Day

1. Light core oven (apply torch before gas is turned on).
2. Pull out shelves and load up with plates of cores.
3. Start baking after oven is hot.
4. Bake for 15 minutes more after they are done. Judge by color. Place on floor to cool.
5. Vent when cool and paste together. Make paste with flour.
6. Put back in oven and bake for 3 minutes.

Soft, weak cores are produced if not enough water has been added, or if the binder is not mixed thoroughly before the water is added.

Student's Guidance Sheet

Reference used: *Wendt's Foundry Work*, pages 135–153.

Students must know something about each topic either from the textbook, demonstration given by the instructor, or from questions asked during the question period.

Topics:

1. Core sand.
2. Binders — Characteristics and percentage used.
3. Water — Action when too much or too little is used.
4. Hard core — Causes.
5. Core Machine — General operation.
6. Casting holes in different directions.
7. Setting core below surface.
8. Venting core through cope.
9. Handling core — Provisions made to place core in mold.
10. Method of holding small two-part core boxes.
11. Reënforcing — Material and methods used.
12. Spraying — Material used and at what time.
13. Venting — Methods used.
14. Blacking material used when applied.
15. Baking — Heat required, construction of oven.
16. How to take care of cores during the baking process.
17. Use of arbors — Reasons for use.
18. Duties of chaplets in connection with dry sand core. Pages 46–48.
19. Lifting hook, how used. Page 106.
20. Venting core in the mold. Pages 63–104.
21. Removing cores from castings — bad effects of core sand mixed in molding sand.
22. What happens to the binder after casting is made.

(Sample Contract)

MOLDING MATERIALS AND TOOLS

Contract Sheet — Unit One

Introduced fourth week of each semester.

Student to know something about each topic either from the textbook, demonstration given by the instructor, or from questions asked during the question period.

Reference used: *Wendt's Foundry Work.*

Topics:

Molding Sand: Qualities, Properties and Characteristics. Pages 13–199.

Tempering, Ramming and Core of Molding Sand.

Facing Materials: Names, Where Obtained, How Obtained, Uses, Purpose and Relation to Carbons.

Tools: The Purpose of: Swab, Mallet, Slick, Clamps, Weights, Rammers, Flasks, Mold Boards, etc. Pages 52–53.

Defective Castings — Cause of Defects such as Scabs, Cold Shuts, Swells, Shrinkages and Pourous Metals.

Gaggers: How Supported in Mold. Material Used in Making. Pages 42–43.

Venting, Ways and Means, Reasons: Kind of Gases that Escape. Page 16.

Gates — Common, Popp with Basin, Skimming and Gating through Core in Bottom. Pages 31–33.

Risers and Feeders; How Made and for What Purpose. Pages 36–37.

Clamps, When and How Used.

Suggestions in Case You Experience Trouble in Molding

1. Too much sand riddled before kneading around pattern.
2. Kneading too close to pattern.
3. Vibrate bench before lifting cope.
4. Rap pattern through the cope.
5. Poor tempering of sand.
6. Pattern in mold the wrong side up.

(Sample Operation Sheet)

GENERAL OPERATION SHEET — UNIT ONE

The fundamentals in making a green-sand mold are covered in this sheet and may be referred to at any time during the course.

Problem No. 1. Flat Back

Presentation: Instructor makes mold, students check on each operation.

Tools and Materials:

Pattern, 2-part flask, shovel, slick, trowel rammer, riddle, mold, board, bottom board, sprue, draw spike, vent wire, strike off. Molding sand, pattern, and spray can.

1. Temper sand: (*a*) add water slowly, (*b*) roll sand from shovel.
2. Examine flask.
3. Determine the parting lines on pattern.
4. Lay pattern on mold board.
5. Place drag with pins downward.
6. Riddle tempered sand over entire pattern with a No. 8 riddle.
7. Use a No. 4 riddle to cover the pattern with 1½ in. of tempered sand.
8. Knead sand around pattern with finger tips.
9. Fill drag and ram edges with peen end of rammer.
10. Spread sand around edges making hollow center.
11. Fill center with sand from shovel.
12. Ram with butt end of rammer, but not below the surface of the drag.
13. Strike off projecting sand. Do not use the slick on the bottom of the drag.
14. Vent, lay bottom board, and roll drag over.
15. Slick well the surface about pattern.
16. Place cope on drag.
17. Use parteen and place sprue 1½ in. from pattern. Proceed as in making drag.
18. Slick off top of cope and draw sprue.
19. Lift off the cope.
20. Spray top of drag, rap and draw pattern.
21. Cut the gate and touch up the edges of the mold.
22. Place mold on floor to be poured. (See instruction sheet on setting up molds.)

Things You Should Know

Draft on pattern: sizes in riddles; ends on rammers; why bottom of drag should be finished different from top of cope; how to use strike off; why the surface between cope and drag should be slicked well; and the shapes of various tools.

Reference used: *Wendt's Foundry Work.*

Tools, Pages 52–53; molding, Pages 59, 60, 61.

The next day the students are given the tools and permitted to work. It usually takes them a few days to learn to temper sand thoroughly and to become accustomed to handling the tools. At first the students are given simple patterns — flat backs and others with indentations involving green-sand cores. The fourth or fifth pattern may be poured if the instructor is satisfied with the quality of the student's mold. The purpose is to arouse interest.

The contract sheet is now handed out. It is used by the student to guide him in his use of the textbook to find reasons for the various operations and the characteristics of the materials used.

Practically all of the problems in Unit One, molding, are worked out by the old problem project. The fundamentals in a simple mold are covered in a general instruction sheet on molding. The other problems are covered, as many as possible, in one mold and an isometric drawing of the pattern that involves these problems is given and accompanied by a problem sheet on the one or more specific problems that the mold involves. The problem sheet is used in conjunction with the general instruction sheet.

After the problems have been covered in this way, the instructor may refer the student back to his problem sheets for any problem he may put into his course. The underlying idea in this scheme is to give the instructor elasticity in his course so that he may introduce problems he favors and at the same time the student must develop his own initiative on new problems from underlying principles developed in the general instructions.

Suggestions for these extra problems might include some machine part used in modern machinery or utilitarian articles which will arouse the student's pride in accomplishing something useful and ornamental.

The accomplishments of the student are recorded on a duplicate progress chart, of which the student has one, and the instructor the other.

HIGH-SCHOOL FOUNDRY

NAME OF STUDENT _____ CLASS _____

GEN. MOLDING (FLAT-BACK, SPLIT PATTERN) (JOB SHEET)																					
CORE MAKING (CONTRACT SHEET)																					
FINISHING																					
JACK TRUNKS (PLATE WORK)																					
JACK HANDLES (PLASTER OF PARIS PATCH)																					
JACK GEARS (PLATE)																					
TOASTER LEG PLATES (PLATE)																					
BENCH VISE (PLATE)																					
FLOOR VISE (LARGE - SMALL)																					
SIDE PAN FOR FORGE (FLOOR - JOB SHEET)																					
FALSE COPING PATTERN (FLOOR)																					
CORE SETTING FOR FLASK (BENCH)																					
TRANSFORMER CASES (PLATE)																					
THREE-PART MOLD (CONE PULLEY)																					
FIRE IRONS (FLOOR)																					
DOUBLE PARTING LINE (PULLEY)																					

FIRST POUR																					
SECOND POUR																					
THIRD POUR																					
FOURTH POUR																					
CUPOLA TENDING (CONTRACT SHEET)																					
BRASS FURNACE																					
TEST 1																					
TEST 2																					
TEST 3																					
TEST 4																					
BOOKS																					
EXTRA																					
EXTRA																					

PROGRESS CHART

Unit Two, given the second month, is taught the same as Unit One. About three class periods are used by the instructor in introducing the work. The instructor, after first convincing the student how necessary is the core department in a foundry in the making of automobile engines and airplane parts, passes out the instruction sheet and proceeds to mix sand and various core binders to make a variety of cores including round, stop off, and cores that require loose pieces. The student then gets a contract sheet on the characteristics of binders, materials, and reasons for various operations. He may have three days at the core bench, two days for making cores, and one day for baking and pasting together. For each class there are a locker and a compartment in which to keep the cores until they are completed and the grades recorded.

Unit Three is introduced the second month. One phase is covered by the instructor's demonstration on operating and repairing white metal furnaces; also the use of a pyrometer in determining the temperature.

The second phase of this unit is taken up the fourth month. It includes the care and operation of the cupola. This is covered first by the teacher's instructions, which are then followed by a contract sheet on the cupola. Many of the students become very efficient and helpful in the preparation of the cupola and in figuring the percentages of various materials used in the operation.

Students pour only after strict drilling in safety rules and organization. Molds are laid on the floor with aisles running between every two molds. There are usually three groups organized; one for pouring, one for weight moving, and one to take care of any mold that breaks. Only one boy is allowed in the aisle while pouring. Weights are moved while the pourer is getting his ladle refilled. Any mold that breaks or metal that spills must be taken care of when the pourer is out of the aisle. One student handles the bull ladle, one does the skimming, three are on the loading platform taking care of the charge. By so doing, most of the class is engaged in the pour. Organizing the class for specific duties the day before the pour has always proved successful and the writer has yet to witness an injury to any student in all his years of teaching the subject.

Unit Four is given out the third month in the form of a contract. It covers the mining, purifying, smelting, and alloying of metals as well as a study with the pyrometer of the melting points of various metals. The students gather their information either from the text or from the teacher's lecture and demonstration in producing brass, bronze, and other alloys.

During the semester, metal is melted two or three times a week. The last eight weeks of the semester are given over to ferrous metals.

One phase of Unit Five, the finishing of aluminum, is introduced the second month by the use of the instruction sheet on aluminum. The finishing of brass and bronze is introduced the third month, the finishing of ferrous castings and the use of the tumbling barrel, the sand-blasting machine, and pickling, if the cast is to be copper plated, are not covered until the fourth month.

Unit Six is a study of methods of production, showing the student by demonstration the speed at which molds can be turned out through the use of a follow board, match plate, and gated patterns. In short, he is learning quantity production now that he has mastered the fundamental principles of molding through his making of individual molds.

The student by using his contract sheet as a guide for the study of his text may learn how production can be further speeded up through the use of molding machines, stripping machines, sand slingers, movable racks, and the layout of modern foundries.

From the combination of instruction sheets, contract sheets, practical work and instructor's demonstrations, a student may organize his information for himself. He does this in his notebook. The instructor may examine the notebook on every unit and use a test to check the value of the book. It is a real incentive to a student to keep a well-organized notebook when he is told from the beginning that he may use it on all tests.

No shop foreman is needed; everybody is for himself. Tools are all set in racks; each student gets his own. Special files, hack saws, screw drivers, scrapers, and such like tools are set out on boards and may be taken only when a boy leaves his name, bench, and class number on a tag placed on the book from which the tools were taken. Each boy in the class is assigned in numerical order to three days at the tool bench.

The foregoing plans allow 20 hours for organization and written work out of the 200 given to the subject. This permits the instructor to make his work as comprehensive as he desires.

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CHART Nº2 OF TYPICAL PROBLEMS IN TRIANGULATION~ BY- C. H. DERBY & J. F. FABER

TWO-WAY BULLHEAD FITTING

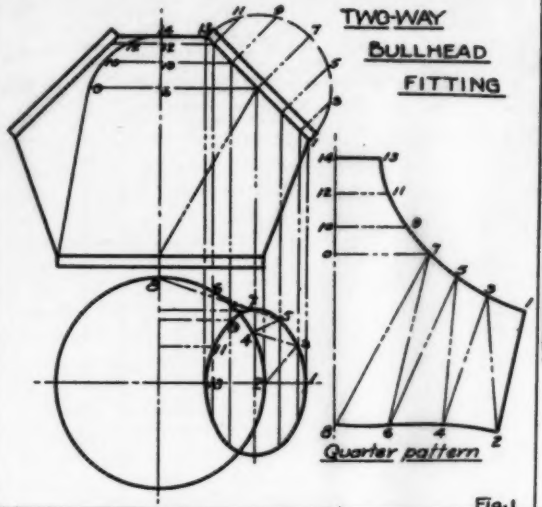

Fig. 1

THREE-WAY FITTING

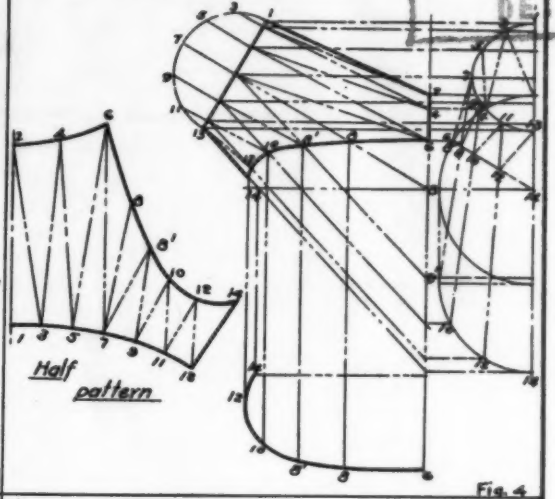

Fig. 4

TWO-WAY BRANCH

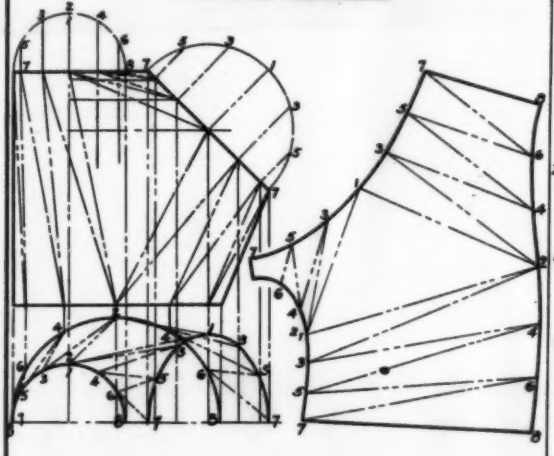

Fig. 2

COMBINATION FITTING

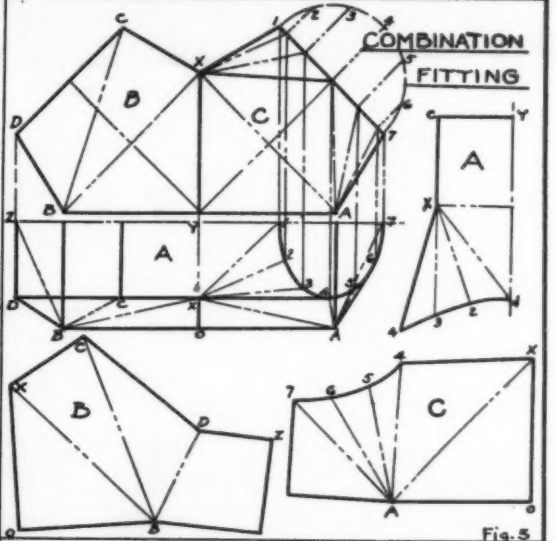

Fig. 5

TWO WAY BRANCH

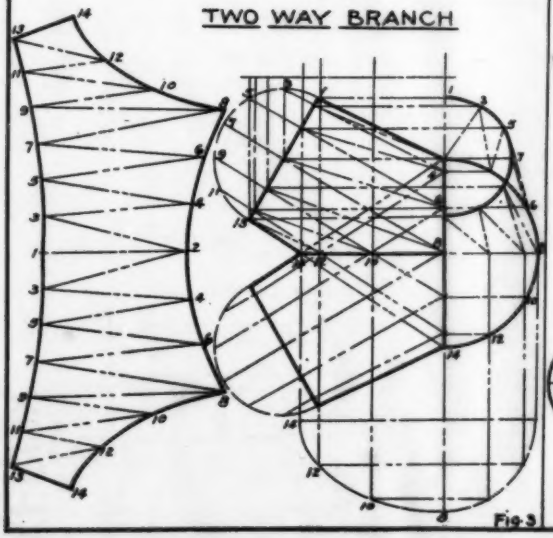

Fig. 3

FOUR BRANCH EXHAUST PIPE FITTING WITH HANDHOLE

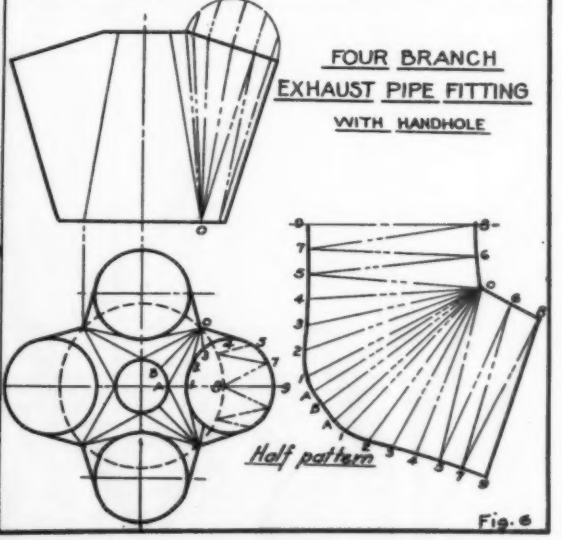

Fig. 6

Submitted by C. H. Derby, Erie, Pa., and J. F. Faber, New York City.

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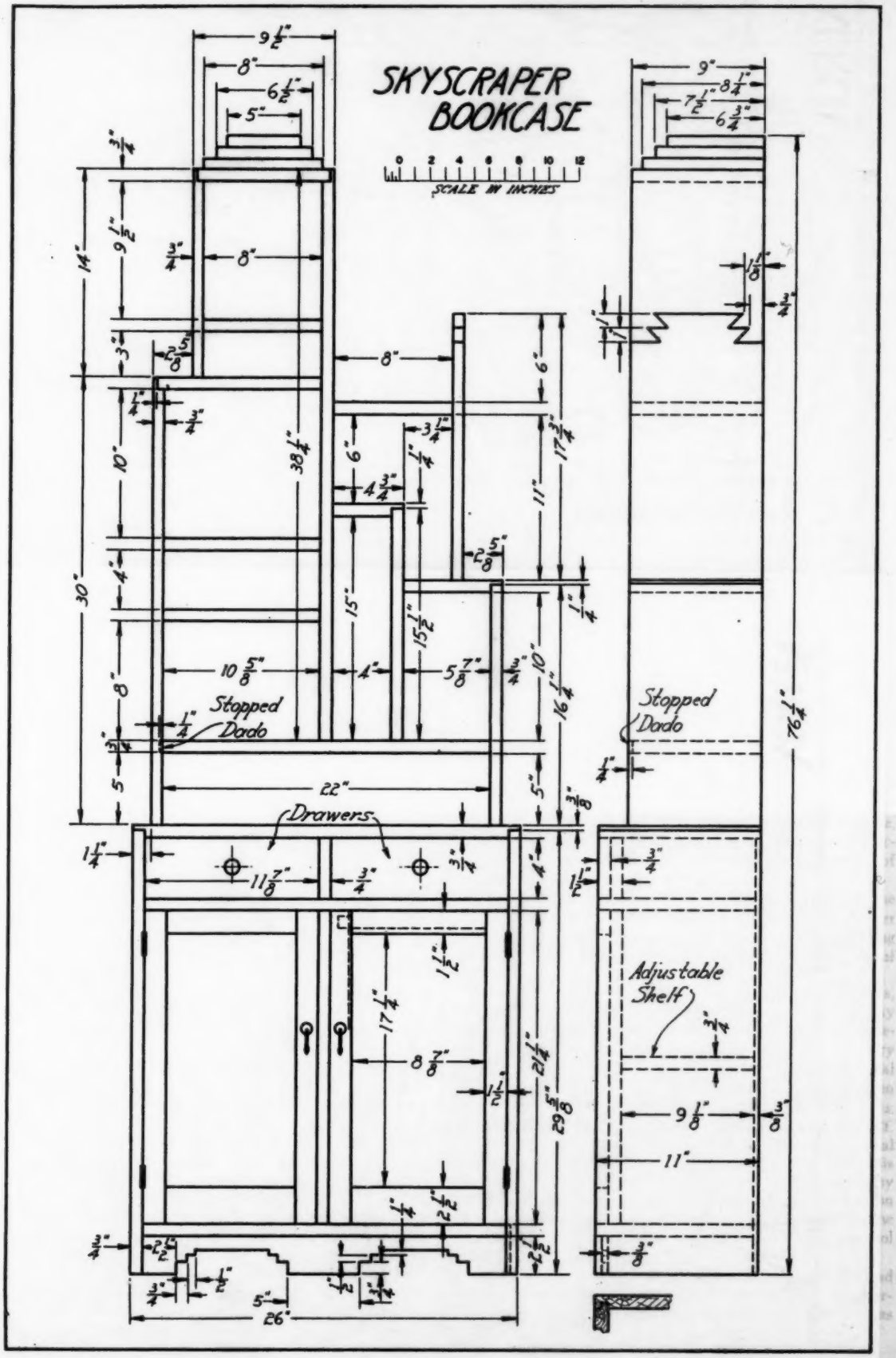
SKYSCRAPER BOOKCASE



Designed by V. E. Broadbent, Santa Clara, Calif.

Described Elsewhere in This Issue

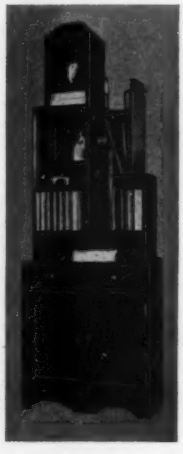
PROBLEMS & PROJECTS

SKYSCRAPER BOOKCASE

V. E. Broadbent, Union High School, Santa Clara, California

(See Supplement No. 248)

The modern skyscraper bookcase described herewith is a popular project with the ninth-grade cabinetmakers. While quite simple, it requires accurate work and care in execution. As shown in the drawing, stopped dado and rabbet joints may be used at the important junctures. However, butt joints glued and nailed, may be substituted to simplify the work.



It will be found easier to assemble the left side of the upper half and add the right section. Slight inaccuracies accumulate alarmingly if all the boards are cut to length separately before any part is assembled. A back is rabbetted into the lower section and may likewise be built into the upper part if desired.

The cabinet may be stained, painted, or lacquered, depending upon the kind of wood used and the finish desired. Some were painted black outside with the entire inside colored red or white. Others had the front edges painted a different color. Several others were made of stained walnut, one very attractive one was finished with the lower half stained much darker than the upper. Bronze or brass fittings on the drawers and doors add much to the appearance of the project.

TYPICAL PROBLEMS IN TRIANGULATION—CHART NO. II

C. H. Derby, Erie, Pennsylvania, and J. F. Faber, New York City

(See Supplement No. 249)

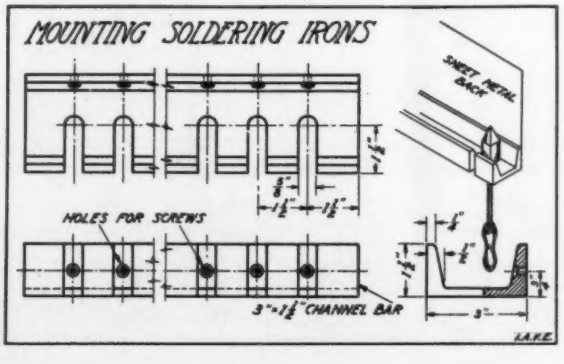
The problems on this chart are a continuation of the typical problems in triangulation which were shown in Supplement No. 244 of the June, 1932, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

The problems present the development of practical fittings used in heating, ventilating, and blowpipe work.

MOUNTING SOLDERING COPPERS

F. D. Rohmer, Director Vocational Education, Midland, Pennsylvania

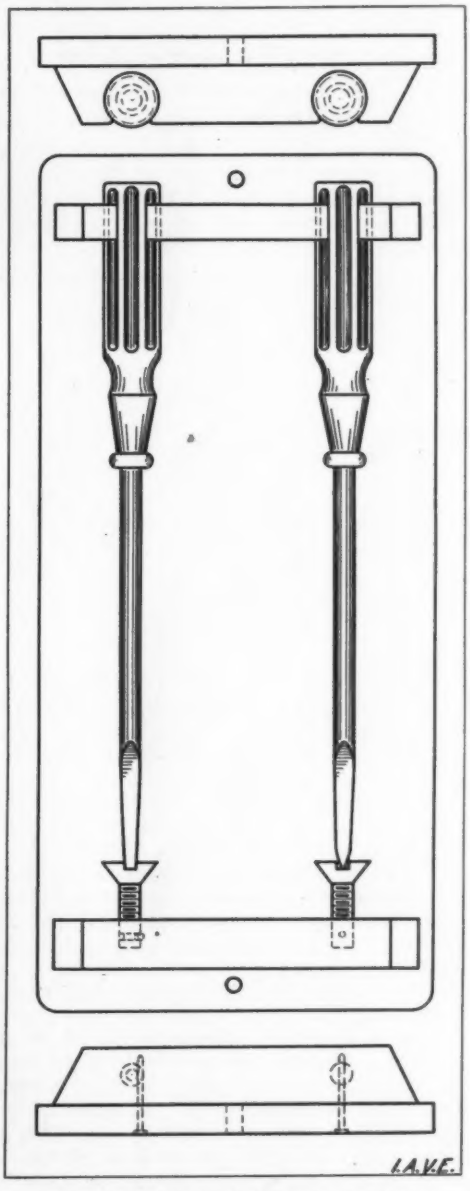
Generally soldering-coppers are left lying around on benches or in the furnaces. This is far from being satisfactory. A handy rack to hold them may be made out of a piece of standard 3 by 1½-in. channel bar. This may be readily fastened to the regular toolroom panel, or on the wall near the furnaces, or on the soldering bench itself. The front web prevents the hot coppers from falling out. This rack may be made to accommodate any desirable number of coppers.



THE SCREW DRIVER—RIGHT AND WRONG

Harvey E. Parry, Boys' Vocational School, Bloomfield, New Jersey

How to properly grind the much-used and much-abused screw driver can be made self-explanatory with the visual aid



THE "WHY" OF SCREW DRIVER GRINDING

described herewith. As shown in the illustration, prepare two wooden screw drivers about 15 in. long. Have one correct with the blade sides flat and nearly parallel. Shape the other screw driver knifelike with well-rounded faces. Turn the screw heads and shanks of a size in proportion to the screw drivers and large enough to be visible at a distance. Mount these in a block as illustrated. Fasten the screw to illustrate the bad practices in screw-driver sharpening, by driving a nail through it, as shown. Arrange the other screw, to exhibit correct practice, so that it will turn. Both screws should be pinned from the back of the block to prevent removal of the pin.

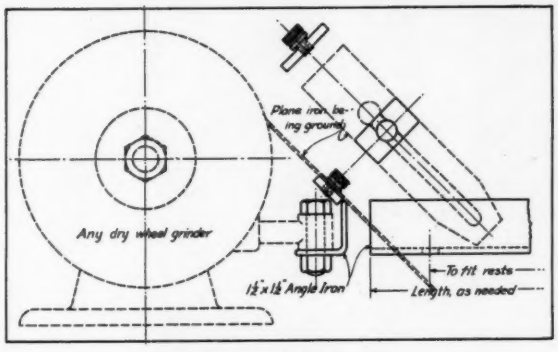
The upper guide requires no explanation and serves only to maintain alignment. Two escutcheon pins should be driven in the screw-driver handles just above this guide to keep the tool from falling to the floor if the blade should free itself from the screw.

Startling decoration will aid in causing student investigation. Enamel the handles, which should be fluted, a brilliant red. Finish the blades and socket in aluminum. Make the screw block of pine, finished natural. For contrast, the back looks well in black.

PLANE-IRON GRINDING JIG

E. M. Wyatt, West Technical High School, Cleveland, Ohio

During a visit to the woodwork shops of the Akron, Ohio, schools, the writer found in use the efficient school-made plane-iron grinding device here illustrated. It was being used on an ordinary two-wheel dry grinder in preference to an oilstone grinder that was standing idle and that must have cost several times as much as the dry grinder with the device.



PLANE-IRON GRINDING JIG

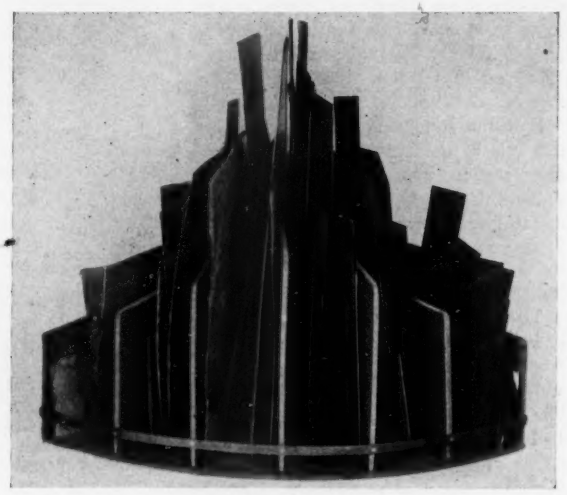
The device is simple, consisting of two parts, a rest that replaces those that come on such grinders, and a holding piece to support and steady the plane iron to be ground. Both can be readily made with ordinary metal-working tools. The rest is simply a piece of angle iron drilled so that it can be bolted either to the underside or the upperside of supports. If both wheels of the grinder are to be used to grind plane irons the rest piece should extend across both supports so that it may serve both grinding wheels. The holding piece is made to fit the slot in plane-iron bits as shown in the drawing. The knurled screw is as large in diameter as will go through the circular end of the slot. With it, the plane iron is clamped immovably to the body of the holding piece.

To prepare for grinding a plane iron, the holding piece is lightly clamped in the plane iron, the device set on the rest so the iron leans against the wheel as illustrated, the proper grinding angle secured by sliding the holder along the plane iron, and then tightening the knurled screw. If a mark has been made on the iron to indicate the setting used for the last grinding, the piece can be set without any trial. While grinding, the plane iron and holder are slid back and forth along the special rest. If a finger is placed lightly on the tool close to the stone while the grinding is being done, it will give plenty of warning to prevent any danger of burning the tool unless excessive pressure is used. The holder need not be removed to check the squareness of the ground end of the iron with a try-square.

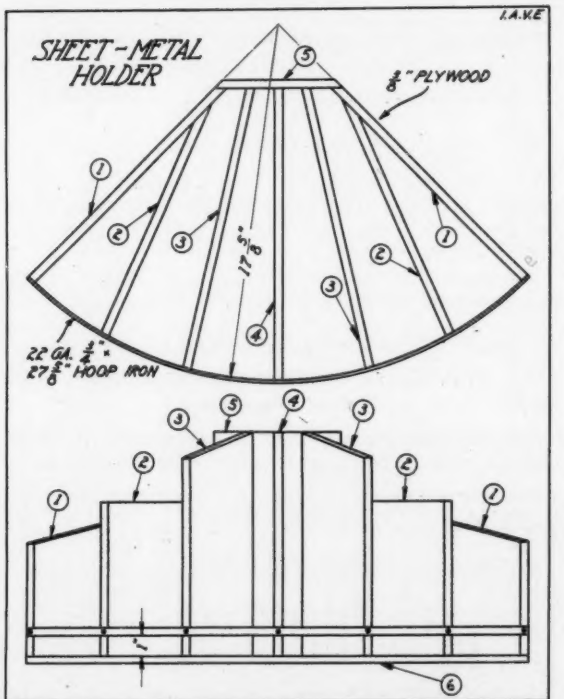
SHEET-METAL RACK

David S. Taff, Jason Lee Intermediate School, Tacoma, Washington

The radial sheet-metal rack illustrated and described herewith has three outstanding features. The first is that it gives an unobstructed view of the metal which it contains; the second is the ease with which small pieces of sheet metal



SHEET-METAL RACK



No.	THICKNESS	WIDTH	LENGTH	
			FRONT EDGE	BACK EDGE
1	3/8"	13 1/4"	5 1/2"	8"
2	3/8"	12 1/2"	7 5/8"	7 5/8"
3	3/8"	14"	9 3/4"	11"
4	3/8"	14 1/4"	11"	11"
5	3/8"	6 1/2"	11 3/8"	
6	3/8"	17 5/8"	17 5/8"	

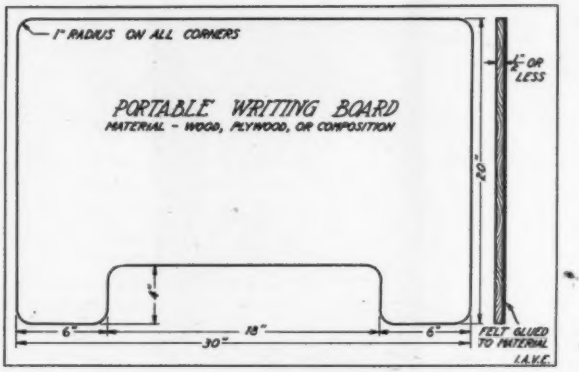
may be placed or withdrawn in the proper compartment; third, the small space which the holder takes up.

The rack shown in the illustration is large enough to take care of the metal scraps in a small general shop.

PORTABLE WRITING BOARD

George F. Billey, Detroit, Michigan

A very convenient writing board, useful also as an emergency writing table for students in school, is shown in the accompanying illustration.



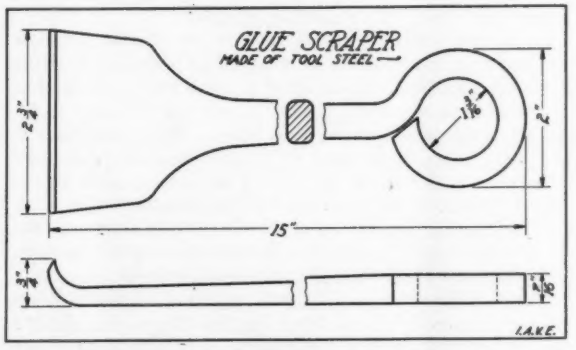
It may be made out of any light material, such as wood, plywood, or composition board. The bottom should be covered with felt, if it is to be used on finished surfaces.

Proportional dimensions may be used in making one for children for special uses.

GLUE SCRAPER

F. N. Newton, Jr., High School, Sharon, Pennsylvania

The scraper described herewith may be readily made in the metal shop.



It should be forged from tool steel in order to insure a good scraping edge.

The edge must then be ground on the emery wheel and whetted on a stone.

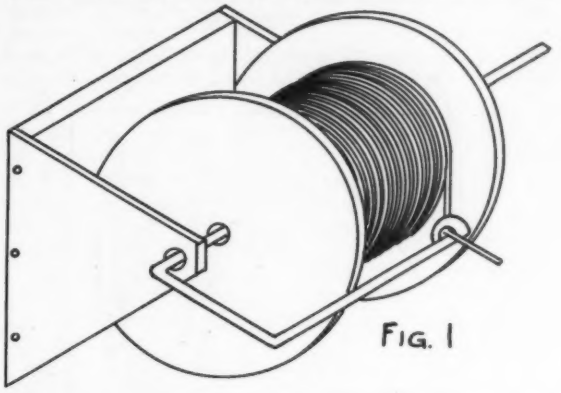
To make a real job, the entire tool may then be filed smooth to get rid of the rough edges and scale left from the forging.

A WIRE SPOOLING DEVICE

Watson L. Deaver, Franklin Junior High School, Long Beach, California

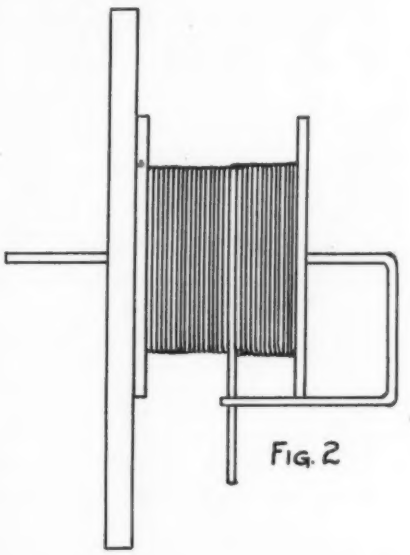
The spooling device described herewith was designed to do away with the tangled condition which usually prevails when students are permitted to cut wire lying in loose bundles.

The spool is mounted on a bracket with a ¼-in. rod as an axle. The rod projects several inches on both sides of the supporting bracket and should be a loose fit in both the spool and the bracket. A guide loop is turned at one end of the rod, after which it is further shaped in the manner shown in Figures 1 and 2. The rod just back of the guide loop presses against the flange of the spool, thus functioning as a brake to prevent rotation of the spool and consequent loosening of the wire.



A tight coil is, therefore, insured at all times as the free end of the wire passes through the loop at the end of the angle and is therefore always held in place.

A pull on the free end of the wire removes part of the braking action, thus making it possible to easily remove the amount of wire required.



Since the spool and the rod are both free to move endwise, the loop will always follow and be directly over its particular coil. It may therefore be used as a tension and spacing device when placing the wire on the spool. The spool may also be used in a vertical position by passing the rod through a hole of suitable size, bored in the top of a bench or shelf. The advantages of this device may be enumerated as follows:

1. An accurate amount of wire may be spooled off, by placing a ruler against the loop and pulling out the desired amount.
2. The end of the wire is always available.
3. The wire on the spool presents a neat and tidy appearance at all times.
4. Bending and kinking of the wire is prevented.
5. The shifting rod together with a crank attached to the

side of the spool makes a level winding device for putting the wire on the spool.

6. The device makes possible a saving of time, material, and annoyance.

MOUNTING PLIERS

F. D. Rohmer, Director Vocational Education,
Midland, Pennsylvania

Difficulty is usually encountered in mounting pliers on a tool panel. The usual method of trying to balance pliers on a

METHOD FOR MOUNTING THE PLIERS
COUNTERSINK FOR FLAT-HEAD WOOD SCREWS
1"
1"
BEND AS SHOWN IN MOUNTED PLIER VIEW. USE NO. 16 GA. BRASS
I.A.V.E.

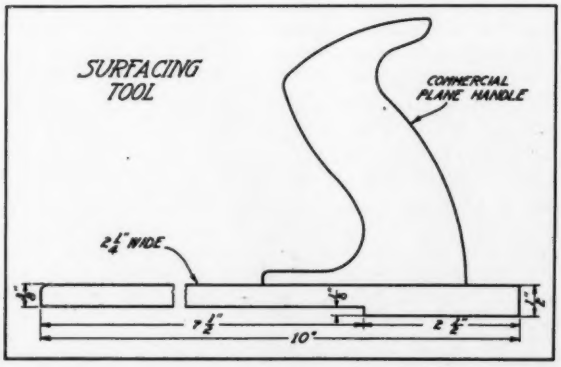
nail or hook is never satisfactory. The method shown herewith gives a solid mount, and permits ready detachment when the pliers are needed.

SURFACING TOOL

J. A. Miller, Director of Vocational Education, New Kensington, Pennsylvania

It is difficult to keep an equal pressure on thin lumber when running it across the jointer. The surfacing tool, described herewith, may be easily made. It is very useful in the school shop for keeping an equal pressure on thin lumber which is to be surfaced on the jointer.

A commercial plane handle is fastened on to a piece of



wood with a ⅛-in. cut-out. If the handle is placed in the position shown, the pressure is fairly well distributed and thin pieces may be surfaced accurately.

HANDLED COUNTERSINK

Marvin Fallgatter, the Cambridge School, Kendall Green, Massachusetts

The tool here illustrated has a usefulness and convenience greatly in excess of that of the usual countersink employed in conjunction with a bit brace. With the latter it is necessary to insert the countersink in the brace, often to place the work in a vise, and turn the brace, requiring two hands; this in spite of the fact that most countersinking requires very little effort. With the tool here shown, all that is necessary is to pick

THE COUNTERSINK IN USE

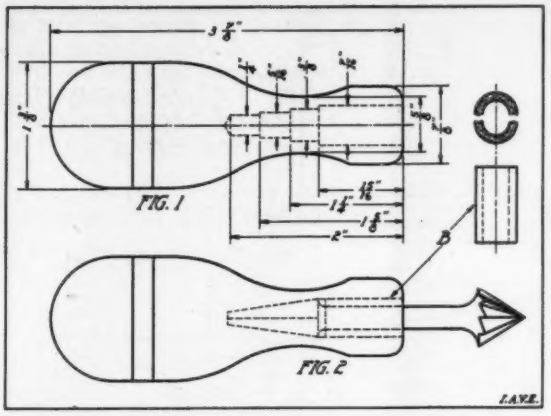
it up, give a few turns using one hand (with the other free to hold the work if necessary), and pass quickly to the next hole requiring countersinking. Not only is the saving in time and effort considerable, but it is quite easy to see when the countersinking has reached the desired depth. This tool also may be used in places inaccessible to a bit brace, and possesses other advantages which will be readily recognized.

As a class project, this tool provides an excellent example of wood turning and of the use of the lathe in drilling. Furthermore, the merit of a class project in which the pupil's interest is centered on something which he will use regularly in his work is appreciated by most shop teachers. By making part of his shop equipment the pupil adds to his sense of appreciation of good tools and of the better work which good tools permit. This little tool is quite suitable for this purpose.

The following description of its construction is general, but it may be adapted readily by the shop teacher to the form of a job sheet which will meet his particular needs.

Figure 1 shows the details of the handle. It should be made of hard maple or of some other suitable hard wood, and if a lathe is provided with a drill chuck on the headstock, it will be best to turn the handle first. Then choose a drill or bit of a diameter equal to or slightly less than the greatest diagonal of the square part of the countersink shank, and drill an axial hole about 1 in. deep, as shown. In the case of a small rose countersink the diameter will be about 7/16 in. The hole may be made truly axial by centering both ends of the finished handle, mounting the drill or bit in the headstock, and holding the handle so that the center of the larger end rests on the dead center, while the other end is being fed into the drill, care having been taken that the drill started in the center. From the bottom of this hole continue for short distances in the same manner but with successively smaller drills in such a manner as to produce a stepped effect, which is calculated to fit the taper of the square shank.

In case the drilling cannot be done in the lathe in this manner, it will be best to drill the holes before turning the



handle. If the piece is about 2 in. square, and the holes have been drilled by hand, then even if the holes are fairly crooked the result will be right if the axis of turning is made to coincide with the axis of the holes. This may be done as follows: Place a dowel in the largest hole for its full depth, having it fit snugly, and project a foot or more. With a straightedge extend the line of the center of the dowel along one face of the square piece for the handle. This can be done by eye with sufficient accuracy. Then do the same for adjacent faces and the opposite face. On the remote end join the endpoints of these lines; the intersection will give the proper point for the center of the spur-center for turning. The point-center will automatically center itself in the end which has been drilled, and the turning will result in a handle which is quite "true" with the axis of the countersink which is to be mounted in it.

The countersink is held in place by the small bushing B, shown in Figure 2. This is easily made with the aid of a chuck, if the lathe is so equipped. If not, first drill a hole lengthwise through a small piece of hard maple, with a drill of diameter equal to that of the round shank of the countersink. Then turn this piece on a pin until the outside diameter is a snug fit for the hole already drilled in the handle. When the bushing is made, split it into two parts, as shown, being careful to keep the parts in their original relative position. Put glue on the inside of the hole in the handle. Insert the countersink, forcing it down slightly so that the square corners of the shank imbed themselves lightly in the wood. Then tap the halves of the bushing into place. The result will be a rigid, neat and permanent job which will serve long as a very handy tool.

RADIUS BLOCK FOR HAND SANDING

F. N. Newton, Jr., High School, Sharon, Pennsylvania

The radius block for hand sanding, described herewith, will be found to be very handy. It may be made quite easily and is inexpensive.

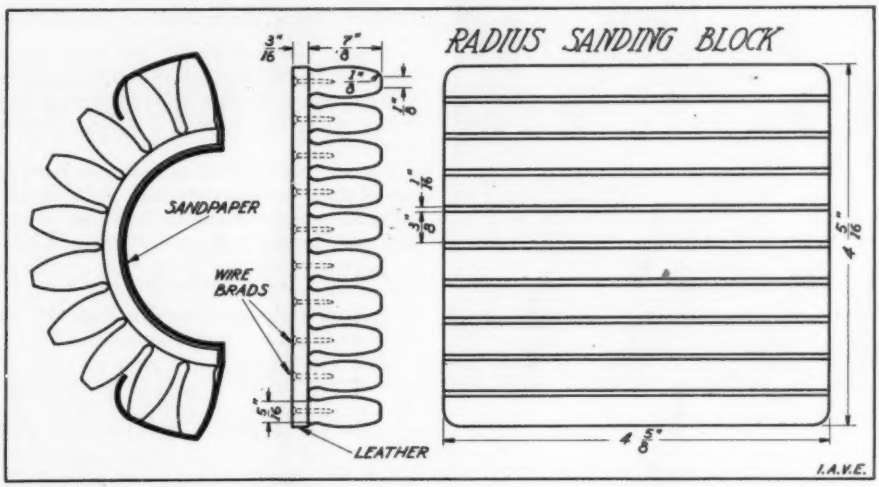
The block conforms to either inside or outside radii, and the sandpaper may be quickly changed whenever necessary. It is placed on the leather side and folded around and into any of the tooth forms. The block is held in the hand by the teeth. This tightens the sandpaper so it does not come out while sanding.

To make such a block, glue a piece of leather 3/16 in. thick to a piece of oak of the desired dimensions. Let the glue dry for a couple of hours, and then lay off the teeth, allowing 1/16 in. between each tooth for sawing. After the teeth have been laid off drive ½-in. wire brads through the leather into the block at about the center of each tooth. This will doubly secure the leather to the block.

The block is then ready to be sawed on the band saw. Cut out each tooth form following the scribed lines. Care must be taken to stop sawing as soon as the saw blade touches the leather.

Smooth up the outer teeth with a file so as to insure a good grip for the hands. The block is then ready for use and will be found very handy.

The sizes of the block may be changed to suit conditions.



BLUE-PRINT-PAPER BOX

A. P. Twogood, Director, Industrial Education, Newton, Iowa

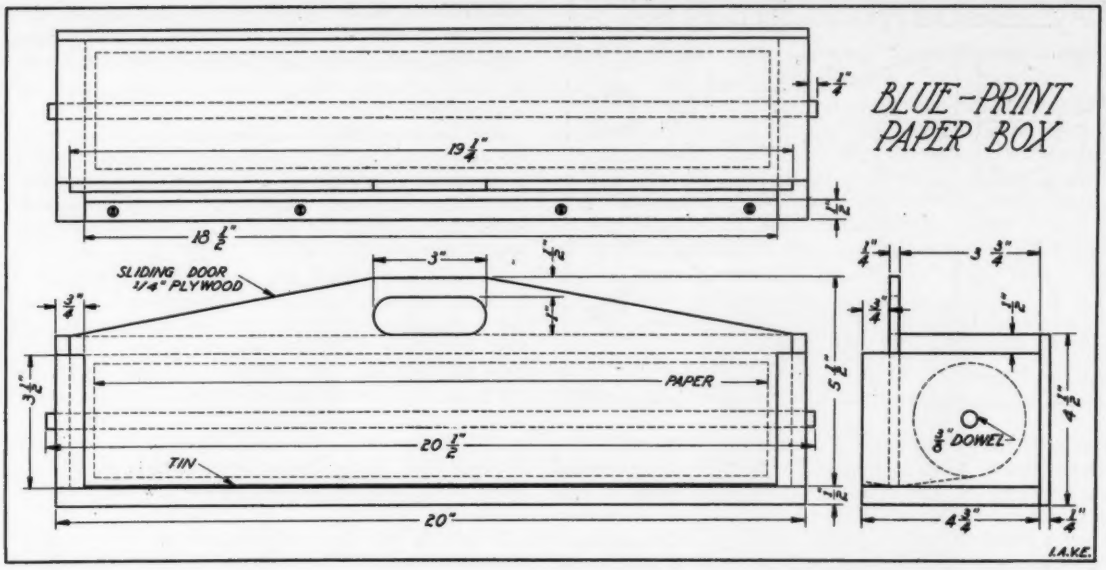
The blue-print-paper box shown in the accompanying illustration has proved very convenient for handling blue-print paper in the roll. Our largest frame is 18 by 24 in., so we buy the 36-in. roll and cut it into two 18-in. rolls. The box was designed to accommodate this size, but it may be built to accommodate any size of roll. The edge against which the paper is torn is faced with heavy tin to provide a sharp corner.

In use the box is placed to the left of the frame as shown in the illustration. The length of paper required may be determined easily as it is drawn across the frame. Enough paper protrudes from the box each time to make it easy to get hold of. Tension on the paper may be regulated by adjusting the sliding door. If desired the box could be mounted on the wall near the blue-print table, but this plan does not seem to be as convenient.

STYLUS

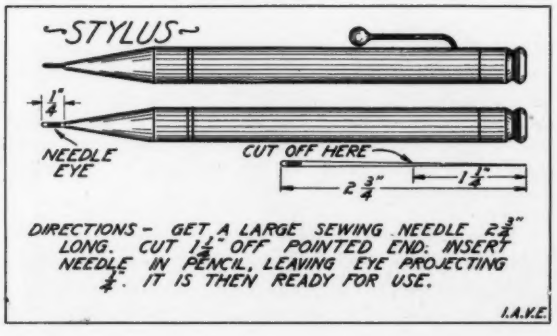
Hyrum Jenkins, South High School, Salt Lake City, Utah

The mimeograph is used a great deal for making instruction sheets for industrial-arts classes. The drawings and sketches



THE BLUE-PRINT-PAPER BOX IN USE

used on these sheets may frequently be made by students in the mechanical-drawing room. Frequently a number of the students may be working at one time at cutting stencils. This would require that a number of styluses would have to be provided. A very good substitute for the commercial stylus may be made by cutting an ordinary sewing needle into two parts and using the end of the needle with the eye as a stylus, as shown in the illustration. In this way each drafting student may be provided with a stylus of his own, which can be carried in his eversharp pencil, along with the extra leads.


STYLUS
1/4"
NEEDLE EYE
CUT OFF HERE
2 3/4"
1 1/4"
DIRECTIONS - GET A LARGE SEWING NEEDLE 2 3/4" LONG. CUT 1 1/4" OFF POINTED END. INSERT NEEDLE IN PENCIL, LEAVING EYE PROJECTING 1/4". IT IS THEN READY FOR USE.
I.A.V.E.

SAFETY DEVICE FOR FOOT-POWER SQUARING SHEARS

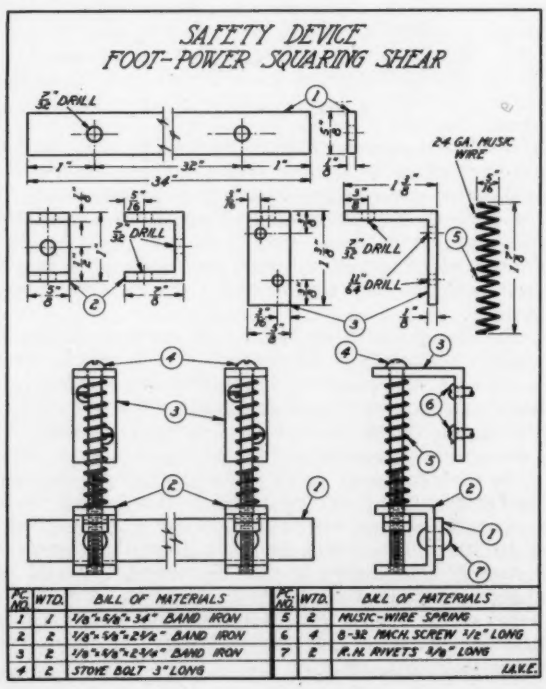
R. Frank Tucker, Grove Junior High School, Denver, Colorado

A safety device that will work without interfering with the operation of the machine is invaluable. The one herein described permits of clear vision between cutter and safety bar. When this device is once attached it will operate without attention.

The material required to make one is usually found in any metal shop. The sizes specified in the illustration are for a 30-in. foot-power machine. The length of the safety bar for any machine may be determined from the length of the cutter.

Method of Procedure

1. Form the hanger, piece No. 3, and drill the holes required to fasten it to the cutter holder.



PC. NO.	WTD.	BILL OF MATERIALS	PC. NO.	WTD.	BILL OF MATERIALS
1	1	1/8"×5/8"×34" BAND IRON	5	2	MUSIC-WIRE SPRING
2	2	1/8"×5/8"×2 1/2" BAND IRON	6	4	8-32 MACH. SCREW 1/2" LONG
3	2	1/8"×5/8"×2 1/2" BAND IRON	7	2	R.H. RIVETS 3/8" LONG
4	2	STOVE BOLT 3" LONG			

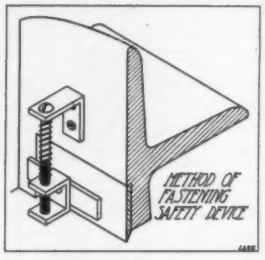
2. Place the hangers 3¼ in. above the bed and mark the location of the holes.

3. Center-punch the holes, and drill and tap them for 8—32 machine screws.

4. Fasten the hangers in place.

5. Form the supports, piece No. 2, and drill the required holes.

6. Cut off a piece of material for the safety bar. Drill the holes through which it is to be riveted to the supports.



7. Fasten the supports to the safety bar.

8. Place the stove bolts into the hangers, put springs in place, and, by means of the two nuts, adjust the safety bar to give it the proper clearance above the bed.

9. Lock the two nuts on the stove bolts, so that the device retains its proper position.

ENLARGED WALL SCALE

Arthur O. Gardner, Kosciuszko Junior Technical High School, Milwaukee, Wisconsin

The large wall scale described herewith was designed as a help to teach new pupils to correctly read an ordinary rule to 1/16th of an inch. On the large board a scale was laid off each inch of which was enlarged to a foot. Two blocks with arrowheads on them were made to slide on the top edge of the scale. This rule proved so satisfactory that it was decided to try placing all of the scales used in the ninth-grade drawing course on one board. The result after some experiment is the wall scale shown in the accompanying illustration. A piece of five-ply yellow pine was used. After it was cut to the sizes given, the slots for the pointers were cut in both edges. Two coats of flat white paint and a coat of white enamel were then applied. The lines representing the divisions of the inch were sprayed on with black lacquer through stencils cut out of heavy paper. Care must be taken to have the paper weighted down when spraying so that it is not lifted by the force of the air.

The wall scale has several outstanding advantages. By cutting the slots for the pointers in the centers of both edges, the four long edges of the board may be used for scales. It was found advantageous to run the scales, excluding the full-sized scale, only to the center of the board. The ⅜ scale does not run through the ¾ scale.

Many methods of teaching may be used. After explaining a scale, the instructor may set the two pointers and ask for group or individual answers. This method may be alternated with the following one: A pupil is asked to set the two pointers. He then calls for individual answers. The first pupil to give the right answer is allowed the privilege of setting the pointers and calling for answers. Tests may be given by having all pupils write on a small sheet of paper the distances represented by ten settings of the pointers.

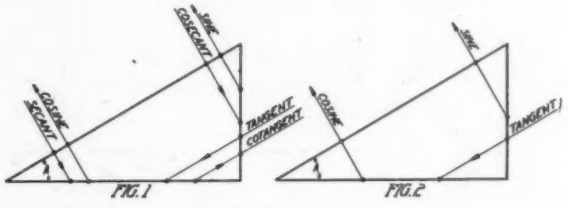
The wall scale was developed for use in the drawing room, but the arithmetic and shop teachers also will find it a very good device for teaching the use of the rule.

A KINK FOR THE MATHEMATICS TEACHER

Raymond A. Prosser, Seneca Vocational School, Buffalo, New York

The teaching of the trigonometric functions has always been troublesome. The method shown herewith has been found quite successful.

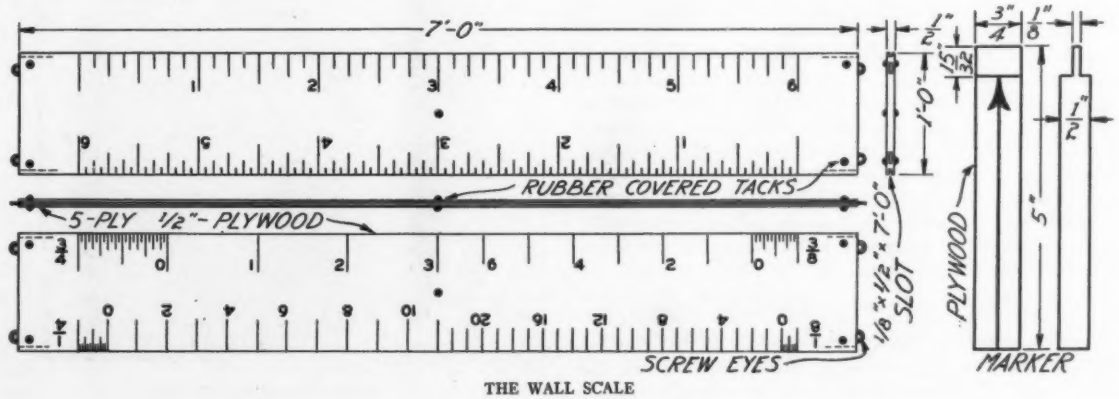
Associate in the student's mind the ratios of the size of the right-angle triangle with the idea of motion. To do this, use arrows drawn on lines cutting the two sides involved in any given function. For instance, in Figure 1, the sine line cuts



through both the side opposite and the hypotenuse, and the arrowhead shows that the action proceeds from the side opposite to the hypotenuse. The cosine function is shown in the same manner, except that it involves the side adjacent and the hypotenuse. The other functions are shown in the same manner.

Once a student acquires the first three motions or functions shown in Figure 2, he is shown that the other three functions involve the same sides of the triangle, except that the arrows on the motion lines are reversed. It is probably easiest to teach the functions in pairs, that is, the function and its cofunction.

It has been found that once the student has acquired the idea of these various motions he retains them indefinitely, even after he gets into industry, where he uses the trigonometric functions only occasionally.



THE WALL SCALE

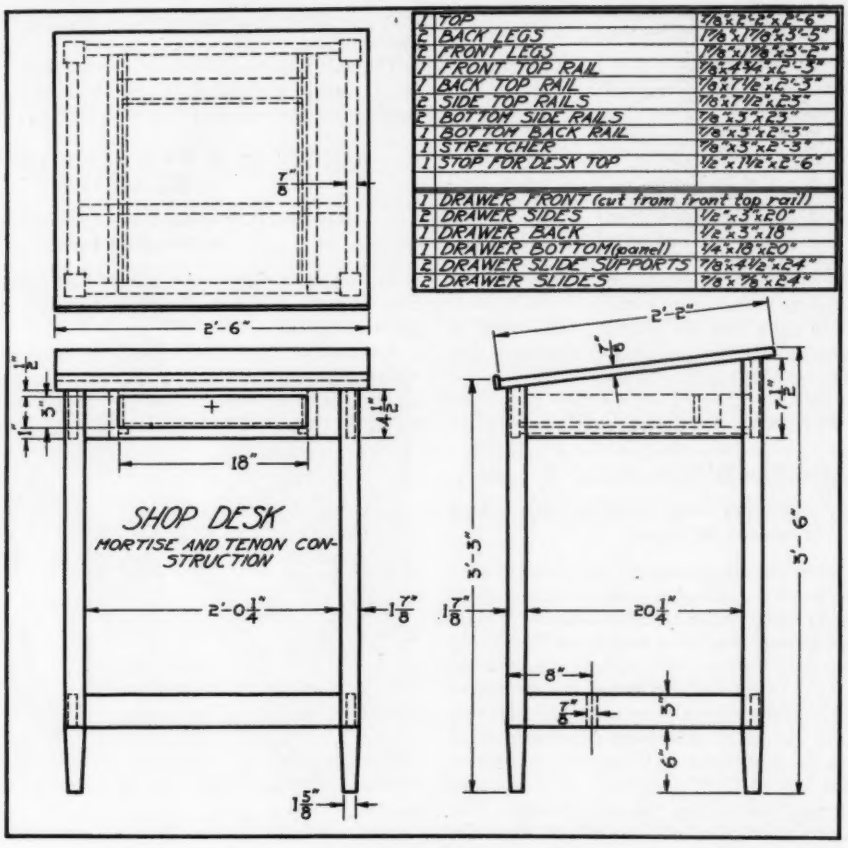
THE SHOP-TEACHER'S DESK

Alexander V. Hanel, Boys' Technical High School, Milwaukee, Wisconsin

The shop desk described in this article was designed to meet the requirements of shop teachers who have large classes, many machines, and much recording to do. It enables the teacher to do the necessary clerical work right in the shop where he can keep an ever-watchful eye on the students.

the glass box is the old reliable which serves the purpose best. The glass box described herewith was developed in a drawing class, and the actual work of construction was undertaken by an advanced student as a special project. The final results were deemed worthy of publishing.

A piece of 3/8-in. birch panel was cut to the exact size of the drawing paper used in the drafting room. This was given a coat of clear lacquer, after which the drawing of a model, complete with border and title space, was penciled and inked



SHOP-TEACHER'S DESK

CIRCULAR SAW USED AS A SANDING DISK

K. W. Little, Rockville High School, Rockville, Connecticut

The teeth on an old circular-saw blade may be removed by grinding or cutting. Sandpaper disks may then be mounted on both sides in the same manner that is used on any metal sanding disk. When dry, place the saw blade on the arbor of the saw, drop table as far as possible, and the improvised sander is ready for work. This method may be used on practically all saws.

If you have a machine-shop department in your school, a disk may be made from heavy-gauge sheet steel, or perhaps a blank saw blade may be purchased from the manufacturer.

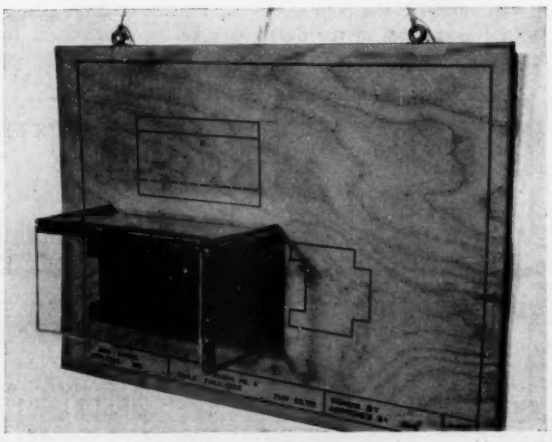
This idea has two distinct advantages over a regular sanding disk. First, there are two sandpaper faces compared with the usual one on regular sanders. Second, the large table permits sanding extra large pieces. By tilting the saw table, the sanding may be done at any desired angle.

THE GLASS PROJECTION BOX

Harry Cameron, High School, Appleton, Wisconsin

Many methods of illustrating the relationship between the various views in orthographic drawings have been tried, but

on it. The complete drawing was given a second coat of clear lacquer to make it permanent. The framework to hold the three plates of glass was made of 1/8-in. steel welding rod,



GLASS PROJECTION BOX

welded together at the corners. The hinges to fit around the frame and attach to the glass, were made of sheet brass bent in the shape of a U, and filed out to fit together as shown in the illustration. Plate glass with edges rounded was used for the planes. The edge of the glass may be rounded and polished easily by using an ordinary carborundum stone and water. The plates were cemented into the hinges with lacquer. The panel was then drilled to receive the frames and glass, and the ends of the frames were driven securely into these holes.

A model of the drawing made on the panel was constructed and fastened over the front view with dowels. This completes the glass box. If the instructor wishes to develop the views on glass planes before opening them up to show the view relationship, he may do so by spraying the planes with a very light coating of show-card white and then tracing the outline of the model on this white coating.

Associations and Conventions

JUNE MEETING OF THE VOCATIONAL EDUCATION SOCIETY OF BOSTON

The June meeting of the Vocational Education Society of Boston was held as a joint outing with the Rhode Island Society for Vocational Education at the Peleg Francis Farm in Rehoboth, Mass., on Saturday, June 4.

The speaker was Dr. Guy M. Wilson, of Boston University. He gave a very interesting talk on the part that the teacher must play in bringing the nation out of its present difficulties.

At the close of a short business meeting the following were elected to office for the coming year: President, Willis C. Brown; vice-president, Hugh J. Cox; secretary, Leslie J. Nutting; treasurer, Louis A. Van Ham; and librarian, Forrest L. Mason. — *Louis A. Van Ham.*

PITTSBURGH TRADE AND INDUSTRIAL-ARTS ASSOCIATION HOLDS INTERESTING MEETING

Two interesting sessions were held at Carnegie Institute of Technology, Pittsburgh, Pa., April 15–16, in connection with the Pittsburgh Trade and Industrial-Arts Association convention. Mr. J. A. Inghram, president of the association, presided at the session on Friday.

Mr. C. S. Coler, of the Westinghouse Electric & Mfg. Company, spoke on the subject of what industry expects of the boy when he leaves school. He urged that the boy be trained so that he takes interest in things and people, is able to adjust himself to economic conditions, is anxious to acquire knowledge, and is ever desirous to know more about industry.

Mr. Guy Bingham, educator and lecturer, Washington, D. C., talked on "The Teacher of Tomorrow." He painted a picture in which he told some things that the teacher must be and do. Mr. P. L. Cressman, of the state education department, discussed briefly the work of the Economy Commission in Washington and the probable curtailment of federal vocational aid.

The meeting on Saturday morning was in charge of Dr. G. D. Whitney, of the University of Pittsburgh. Mr. T. E. Jones, supervisor of vocational education at Youngstown, Ohio, took as his subject, "The Teacher at the Crossroads," in which he pointed out that we need a ledger sheet to show the justification of industrial work in the schools. Dr. Homer J. Smith, of the University of Minnesota, gave a comprehensive outline of what an industrial-arts or vocational program should encompass. He said that industrial training should begin in the elementary school, that there should be six constant subjects in the junior high school, and that the day trade school should be self-contained and not coöperative. He urged long-term rather than short-unit courses. Mr. G. U. Cleeton, of Carnegie Institute, Pittsburgh, gave the summary of the meeting. — *George C. Donson.*

WARNER HEADS WESTERN ARTS ASSOCIATION

DR. WILLIAM E. WARNER

Dr. W. E. Warner, associate professor industrial arts, Ohio State University, Columbus, Ohio, active in a number of educational organizations, was elected president of the Western Arts Association at its convention held May 4–7, at Saint Louis, Missouri.

MANUAL-ARTS SUPERVISORS MEET

The third annual meeting of the Council of Manual Arts Supervisors was held April 22 and 23 at Hotel Gladstone, Chicago. The meeting was called to order promptly at 9 a.m., Friday, April 22, by Mr. Leroy P. Elliott, director of industrial education, Peoria, Ill., chairman.

"The Functions and Duties of the City Supervisor of Manual Arts under the New Administrative Set-Up," "A Basic Philosophy of Education for City Supervisors of Manual Arts," "Changing Objectives in Manual-Arts Instruction," and "Meeting New Requirements of Increased Teaching Load, Decreased Length of Shop Period, and Increased Length of Teaching Day," were the subjects discussed on the first day of the meeting.

On Saturday morning the "Objectives of the A.V.A. Committee on Standards of Attainment in Industrial-Arts Teaching" were discussed, as was also the question whether the A.V.A. is fully and satisfactorily meeting the manual-arts movement for a national organization.

Among Industrial-Arts Teachers

FRANK R. CAUCH DIES

Vocational education loses a staunch friend in the passing of Frank R. Cauch on June 10, who was for 28 years in charge of industrial arts and vocational education in the Oakland, California, public schools.

Mr. Cauch was born in Illinois in 1860. His early home was in Fairbury in that state, where he finished high school. He then came to San Jose where he graduated from the State Normal School. During the sixteen years following, he taught in several places in this state including the Normal School from which he graduated.

Following a course in Columbia University, and his graduation with the bachelor's degree in 1904, he came to the supervisorship of manual training in the Oakland public schools, where he has since served.

His rare good judgment in all the affairs of his department, together with his understanding and sympathetic contacts throughout the schools, have endeared him to his coworkers and to all who have known him.

¶ Dr. Louis V. Newkirk, of the Chicago Normal College, Chicago, Ill., is a member of the summer-school faculty at the Illinois State Normal University, Normal, Ill.

¶ Miss Margaret Johnson, supervisor of home economics for the state board of education of Wisconsin, died at Hamilton, Mont., on June 2.

¶ Mr. G. J. Ehart, director of the vocational school at Janesville, Wis., is a member of the faculty at the summer session of the Whitewater Normal School.

Now, Are There Any Questions?

ANNEALING TOOL STEEL

962. Q.: In the machine shop we often use old hack-saw blades (large power blades) for making other tools and need to make holes in them. Heating the blades does not remove all the temper and they are very hard to drill, and punching them with a center punch does not make a very neat job. Can you suggest any better way to do the job? — *S. W. W.*

A.: *Machinery's Book on Shop Receipts,* published by the Industrial Press, New York City, gives the following methods for annealing steel:

Annealing Steel — 2: Cover the steel with fine clay and heat to a red heat, then allow the steel to cool overnight in a furnace or forge. This method will prove satisfactory when other means fail.

Annealing Steel — 3: Smear the iron or steel with tallow and heat slowly in a charcoal fire until it is a dark red. Allow it to cool itself. This method is all right for very hard tool steel.

Annealing Steel — 4: When annealing flat stock heat evenly and thoroughly, place between two planed pine boards on an ash heap and cover with ashes. Allow to remain until steel has cooled.

New Publications

Perspective Simplified

By Edwin Delos Hoyt. Cloth, 130 pages, 8½ by 5¾, illustrated. Price, $1.50. Published by John Wiley & Sons, Inc., New York City.

This little booklet introduces a simple system of perspective drawing using a unit cube as the basis. It is divided into three parts, the first one on perspective sketching, the second one on advanced perspective, which also introduces shadows, and the third part on architectural perspective. A number of test questions have been added to each section of the book.

Occupations Through Problems

By James B. Edmonson and Arthur Dondineau. Cloth, 214 pages, 5½ by 8, illustrated. Price, 80 cents. Published by The Macmillan Company, New York City.

The authors of this textbook on occupations have succeeded in covering a wide range of vocational interests. The book is designed for the upper grades of the junior high school. The problems have been carefully selected, and give each pupil an opportunity to learn about actual life conditions by individual research.

One Thousand Problems in Industrial Education

By Homer J. Smith. Paper, 90 pages, 5 by 7½. Price, $1. Published by The University of Minnesota Press, Minneapolis.

The author has attempted in this book to set up a comprehensive list of topics that are worthy of study. This is especially helpful to the student of graduate work who is casting about for a subject for his thesis.

News Notes

Additional Year of Vocational Work

An additional year of vocational high-school work will be offered next year in the high school at Schenectady, N. Y. Machine-shop, electrical, printing, and dressmaking courses will be reorganized to place them on a state-accredited basis. All present vocational courses will be continued in the fall and state credit will be obtained as far as the school facilities permit.

Vocational Guidance

The board of education at Two Rivers, Wis., has voted to retain the vocational-guidance course during the next school year.

List of Motion-Picture Films on Mining

The United States Bureau of Mines, has issued an abbreviated list of motion-picture films, which are available to educational institutions and public schools for supplementary teaching aids. The films are silent and depict mining and related manufacturing processes, show where minerals are found and how they are extracted from the earth, how to prevent accidents, and how to protect human life. The films may be borrowed direct from the Bureau of Mines Experiment Station, or any field office. A complete library of all pictures listed may be obtained from the bureau's experiment station at 4800 Forbes St., Pittsburgh, Pa.

Receive $34,000 for Vocational Education

The State of Wyoming will receive $33,948 a year from federal sources for vocational education.

Trade School in New Location

The trade school at Owensboro, Ky., has been moved to the Longfellow School. The basement will house the auto-mechanics department.

Homemade Field-Lighting System

A homemade, inexpensive lighting system for use on small football fields may be made in the school shop, at a cost of less than $750. The system which provides adequate lighting for the field, will increase gate receipts and make it possible for the school to have games outside of school hours. School systems desiring to solve the problem of holding football games without interfering with the reglular school program, may obtain complete information from Mr. E. T. Robbins, superintendent of schools, Hearne, Tex.

Home Economics Association Meeting

The twenty-fifth annual meeting of the American Home Economics Association was held June 20 to 25, at Atlanta, Ga. The topic for discussion was "Revaluations in Home Economics." Among the speakers at the meeting were O. C. Carmichael, Dr. W. A. Sutton, Miss Mary Anderson, Dr. John L. Elliott, Dr. Paul H. Nystrom, Dr. John M. Gries, F. B. Bomberger, Prof. R. P. Bridgman, and Prof. John E. Anderson. A conference on home economics in education by radio was held, with talks by Armstrong Perry, C. M. Koon, Mrs. Marian S. Carter, and Morse Salisbury. The regular business session was held and there was a banquet for the members.

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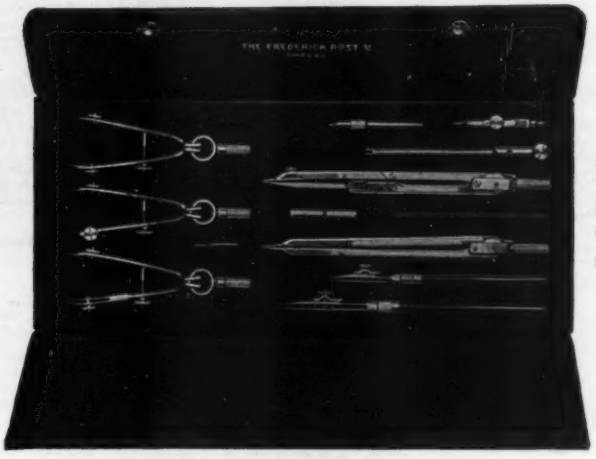

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SCHOOL SHOP EQUIPMENT NEWS

FOR THE SUPERVISOR OR TEACHER WHO DESIRES TO KEEP ABREAST WITH THE NEWS OF NEW MACHINERY, TOOLS, SUPPLIES, ETC.

YATES-AMERICAN TILTING-ARBOR VARIETY SAW

The Yates-American Machine Company, of Beloit, Wis., has announced its new Type G-90 tilting-arbor variety saw, which is designed for use in cabinetmaking shops.

This saw is built on a sturdy one-piece frame, with clean-

YATES-AMERICAN TILTING-ARBOR VARIETY SAW

cut sides to avoid projecting parts. Its 5-h.p. motor, running at 3600 r.p.m., is mounted directly on the tilting arbor. The motor is entirely inclosed, and it is fan-cooled. The table is 40 by 52 in. and it tilts 45 deg. to the right. The motor control is by magnetic switch, push-button operated, with overload and undervoltage protection.

Complete information may be obtained by any shop instructor upon request.

NEW MAYDOLE OCTOLE HAMMER

The David Maydole Tool Corporation of Norwich, New York, has announced its new Octole octagonal hammer. The polished octagonal head and neck, double-tapered adz-eye, round-bell face, and Maydole wedging make this an exceptionally fine hammer.

NEW NIAGARA MACHINES FOR SHEET-METAL WORK

The Niagara Machine & Tool Works, Buffalo, N. Y., has issued an illustrated pamphlet, describing its slip-roll forming machines. These may be had in a variety of types and sizes, and in both hand and power operated forms.

A copy of bulletin No. 77 is ready for any shop instructor who will write for it.

LINCOLN ARC-WELDING SUPPLIES

The Lincoln Electric Company, Cleveland, Ohio, has issued a 24-page circular, illustrating and describing its line of arc-welding supplies, including fleetweld, stainweld, aluminweld, carbon electrodes, shields, holders, cables, autogenizers, and other accessories.

The Lincoln Company offers to the welding industry a line of supplies which it has proved by continuous use in its own welding work. It represents the efforts of welding engineers who combine expert knowledge with practical welding ability and all equipment and supplies produced by the firm enable the operator to do the most work at a reasonable cost.

The School Shop Shopping Guide

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Sheets: 24"x36" or smaller
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Specify size and gauge.
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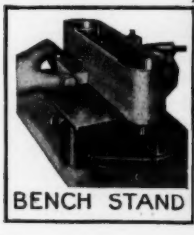
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NEWS NOTES

(Continued)

Prizes Awarded in Art Metal Crafts Contest

William Dixon, Inc., have announced the awarding of the prizes in the eighth annual art metal crafts contest, a national competition for creative work in art and literature in the high schools. Two of the groups for which prizes were awarded — jewelry and metal crafts — were comparatively new in the high-school course, and the number of schools submitting work in these lines had multiplied by four over previous years. The metal work, it was found, exceeded the jewelry in the extent of subjects and design, although jewelry showed a more faithful attention to technique. One veteran group in metal crafts took five of the six major prizes in the two groups.

The first prize in jewelry, $50, was awarded to Michael Vizzini, Detroit, Mich.; the second prize, $25, to George Pennman, Pittsburgh, Pa.; the third prize, $15, to Michael Ursulescu, Detroit, Mich.

The first prize in metal work other than jewelry, $50, was awarded to Dean Thomson, Detroit, Mich.; the second prize, $25, to Leroy Wambaugh, Detroit, Mich.; the third prize, $15, to Alice Foege, Detroit, Mich. Ten persons were given honorable mention and $7.50 in merchandise.

Vacation Schools

The school board of Portland, Oreg. has received a request from the vocational education committee, to open several of the city schools during the vacation months. Mr. B. F. Boynton, head of the education committee, pointed out that with the closing of the schools, some 20,000 school children would have no place to go. It was suggested that manual-training schools might be conducted in five schools.

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The No. 1 Model is a favorite in school print shops. The No. 0, No. 2 and No. 3 are also adaptable for use in these shops.

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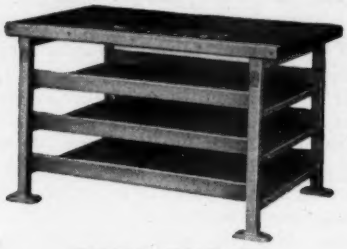

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"The time has come," the walrus said, "to speak of many things." Let us remind you, in this Shop Utilities Number, that it is time to think of "New Britain" when considering Shop Equipment. Whether it be Stake Benches, Cabinet Benches, Work Benches, Manual Training Benches, or just plain benches, with Steel Tops, Maple Tops, Lead-covered Tops, Acid-resisting Tops, or what have you, remember that *"New Britain" must satisfy!*

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